(No Model.) 6 Sheets—Sheet 1.

J. J. BREACH.

MACHINE FOR CUTTING BOOT AND SHOE SOLES.

No. 318,540. Patented May 26, 1885.

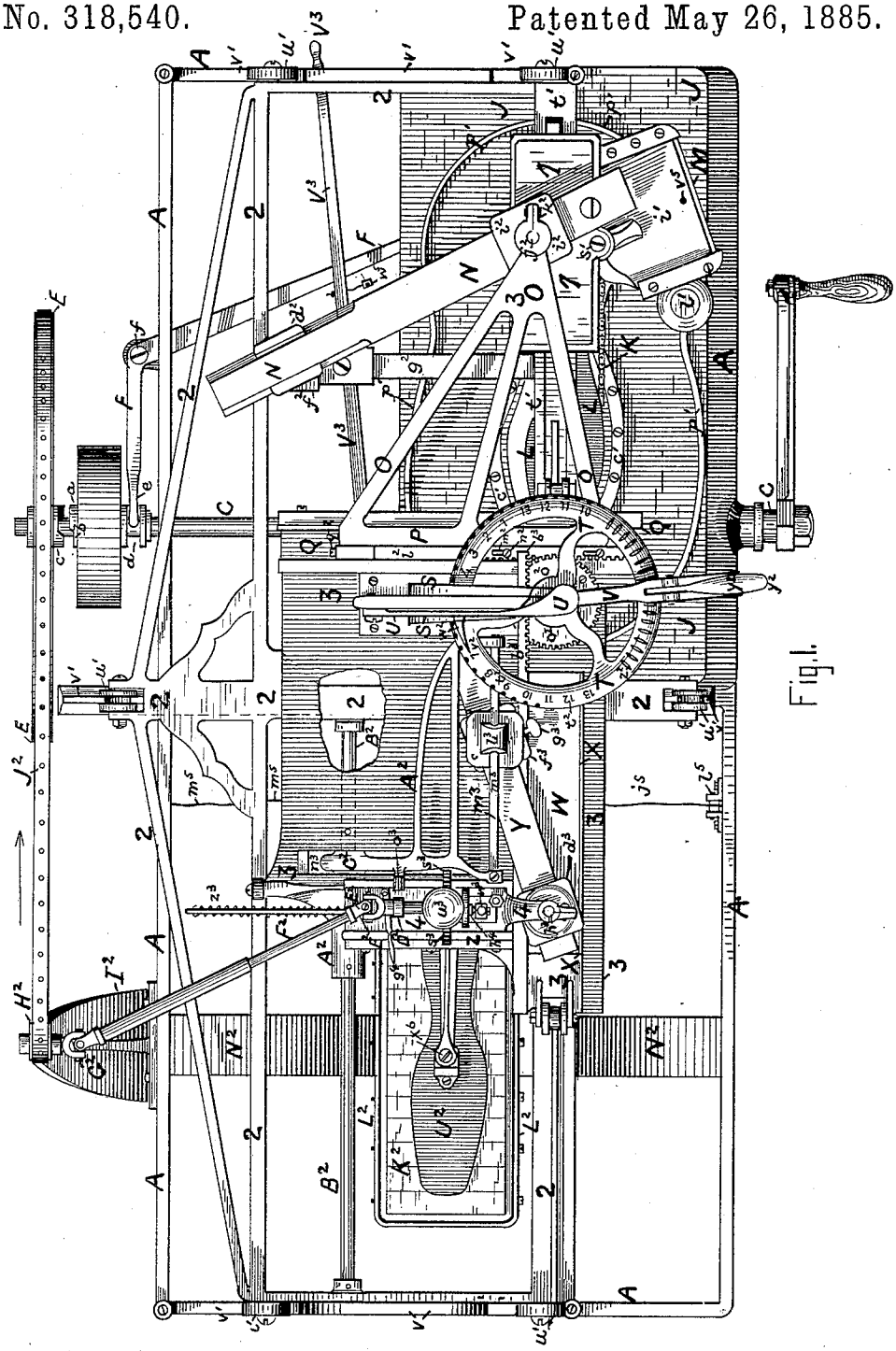


Fig. 1.

Witnesses.
H. W. Keever.
Wm. S. Bellows.

Inventor.
James J. Breach
per Brown Bros.
Attorneys.

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 6 Sheets—Sheet 2.

J. J. BREACH.

MACHINE FOR CUTTING BOOT AND SHOE SOLES.

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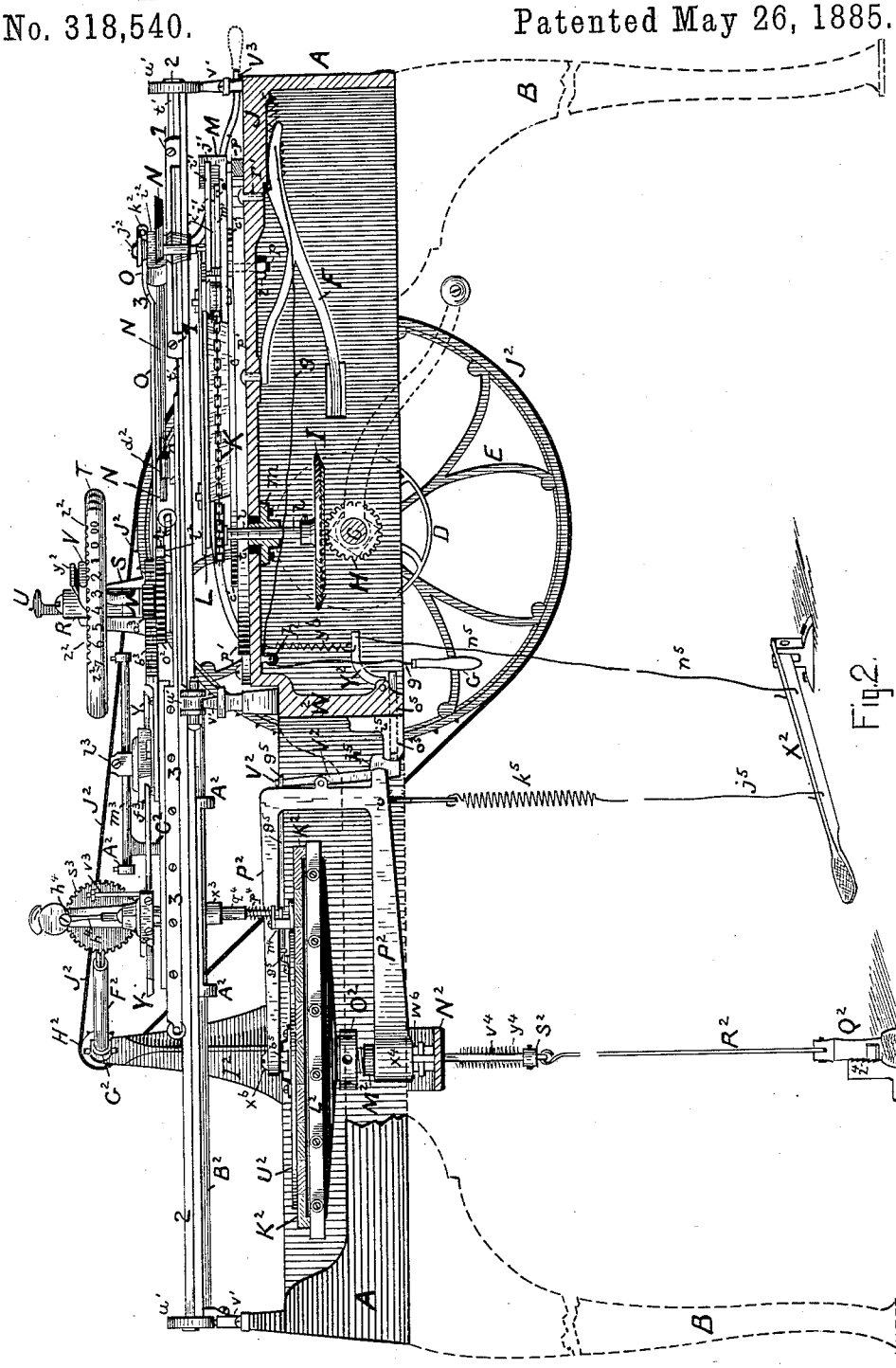


Fig. 2.

Witnesses.
H. F. McKeever.
Wm. S. Rollins.

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(No Model.) 6 Sheets—Sheet 3.

J. J. BREACH.

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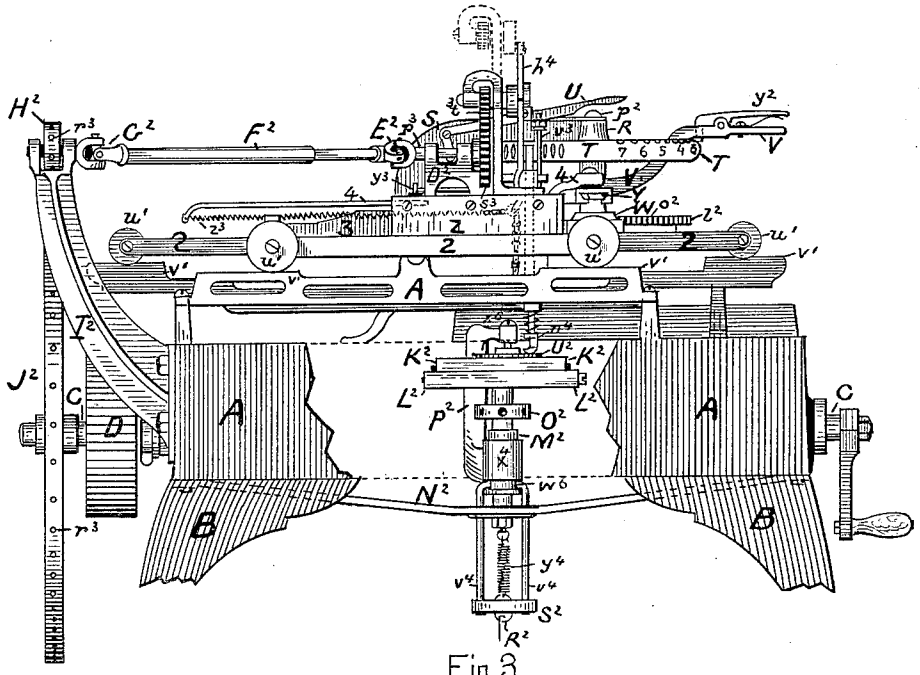


Fig. 3.

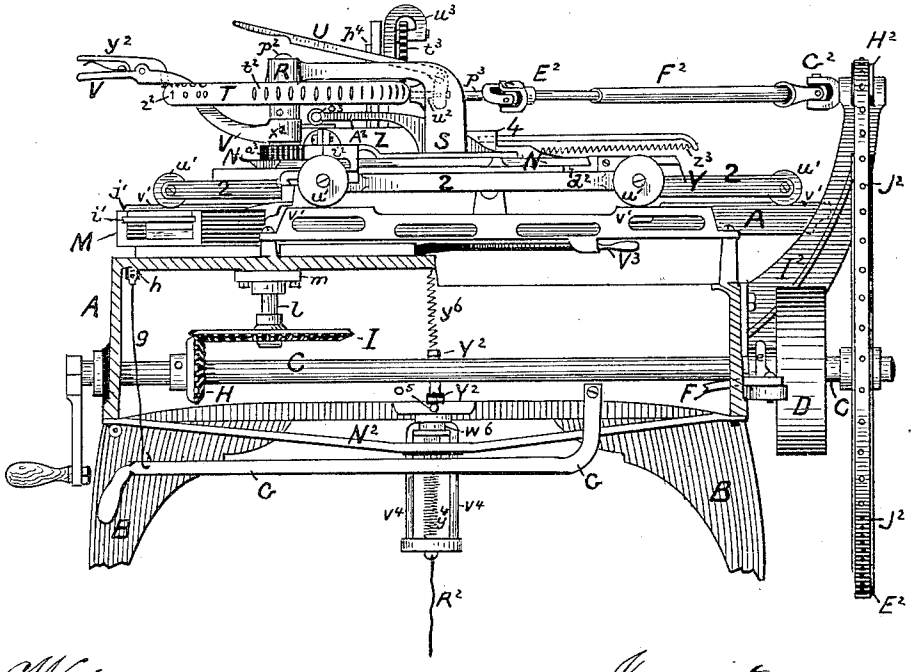


Fig. 4.

Witnesses:
N. F. McKeever.
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Attorneys.

N. PETERS. Photo-Lithographer, Washington, D. C.

(No Model.) 6 Sheets—Sheet 4.

J. J. BREACH.

MACHINE FOR CUTTING BOOT AND SHOE SOLES.

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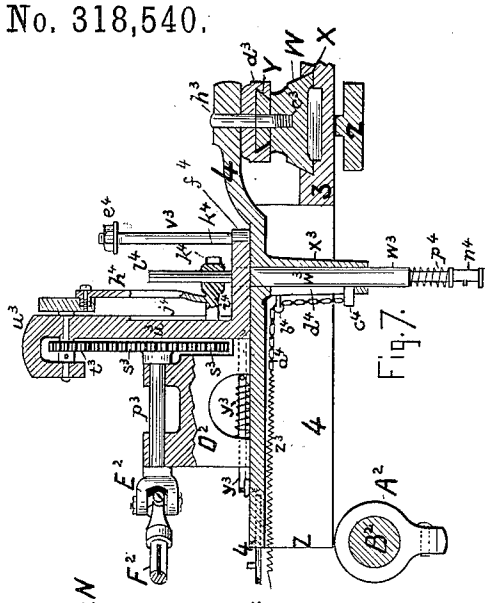


Fig. 7.

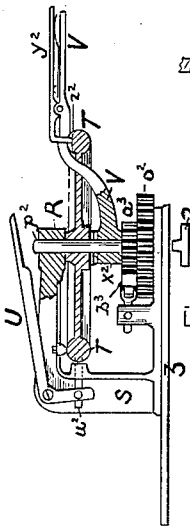


Fig. 13.

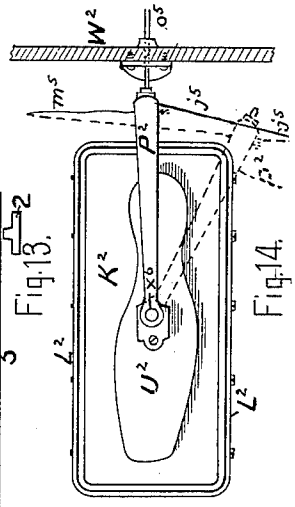


Fig. 14.

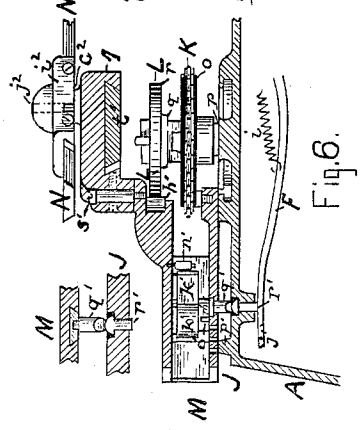


Fig. 6.

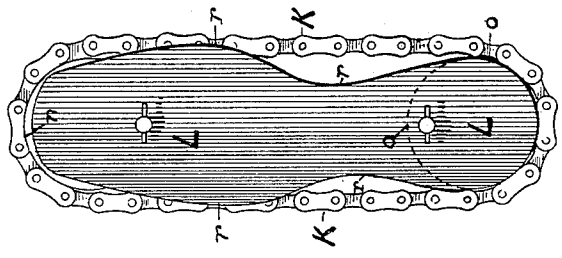


Fig. 12.

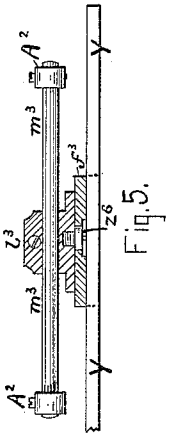


Fig. 5.

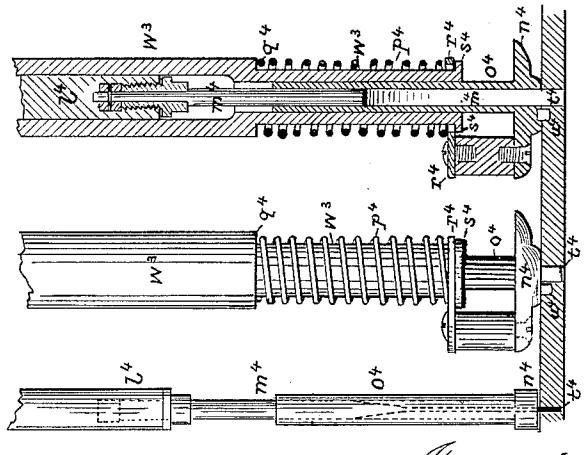


Fig. 10.

Fig. 9.

Fig. 8.

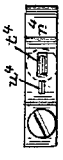


Fig. 11.

Witnesses
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(No Model.) 6 Sheets—Sheet 5.

J. J. BREACH.

MACHINE FOR CUTTING BOOT AND SHOE SOLES.

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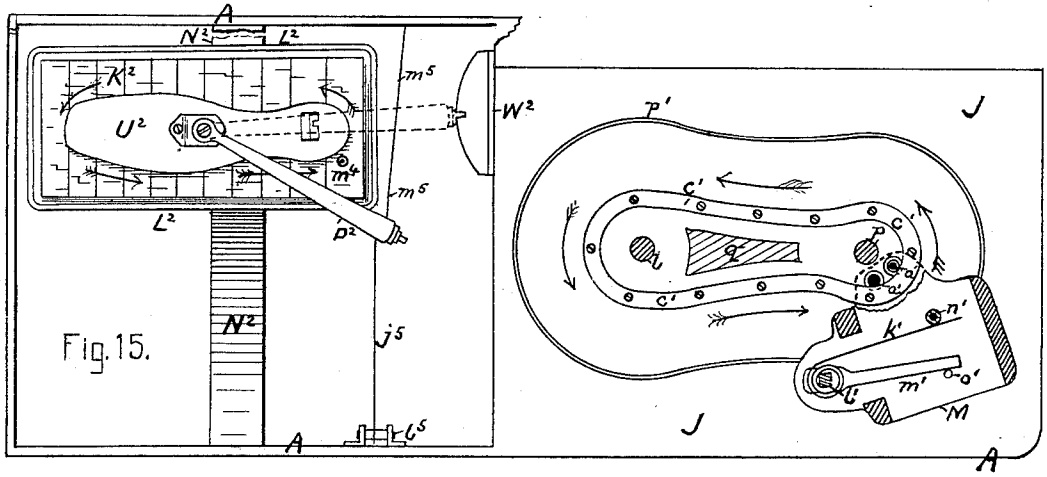


Fig. 15.

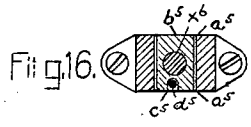


Fig. 16.

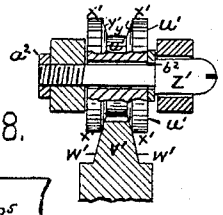


Fig. 18.

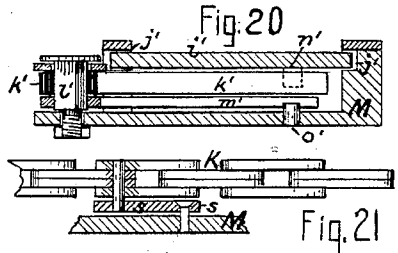


Fig. 20.

Fig. 21.

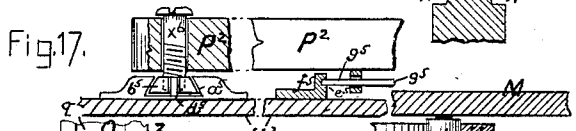
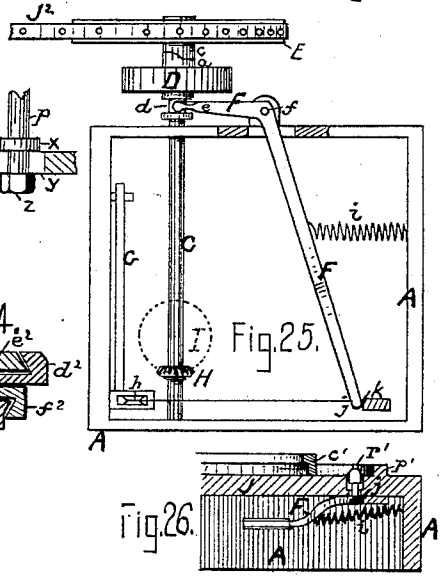


Fig. 17.



Fig. 19.



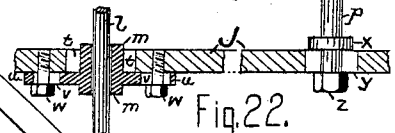


Fig. 22.

Fig. 23.

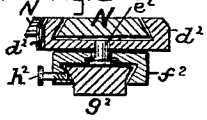


Fig. 24.

Fig. 25.

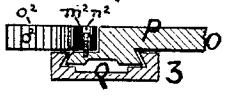


Fig. 27.

Fig. 26.

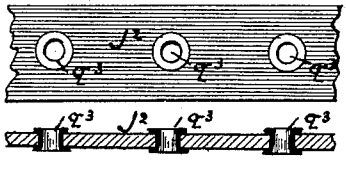


Fig. 28.

Fig. 29.

Witnesses
A. D. W. Keever.
Wm. E. Dillon.

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(No Model.) 6 Sheets—Sheet 6.

J. J. BREACH.

MACHINE FOR CUTTING BOOT AND SHOE SOLES.

No. 318,540. Patented May 26, 1885.

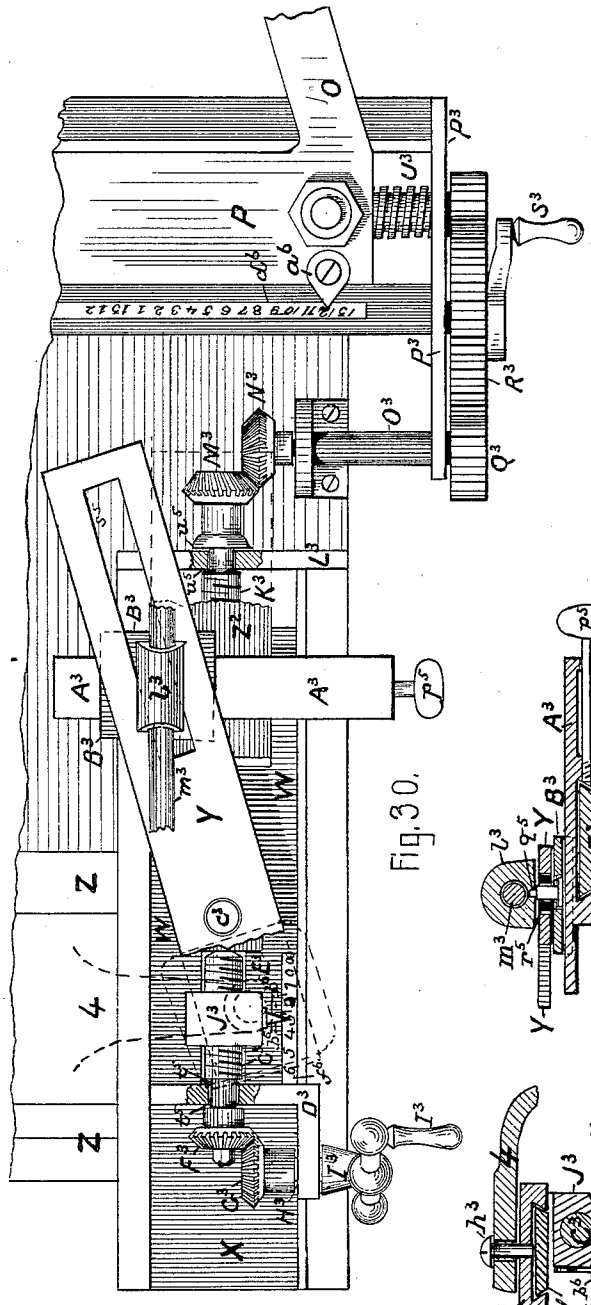


Fig. 30.

Fig. 33.

Fig. 32.

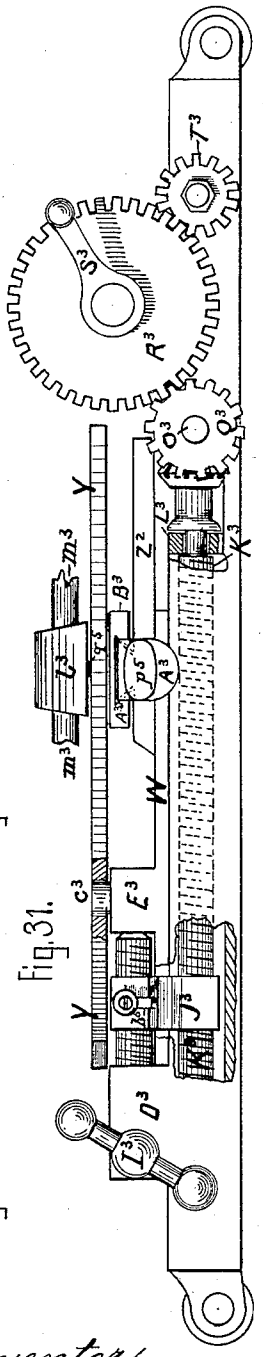


Fig. 31.

Witnesses
H. B. McKeever.
Wm. S. Billows.

Inventor.
James J. Breach
per Brown Bros
Attorneys.

N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

JAMES J. BREACH, OF SOUTH WEYMOUTH, MASSACHUSETTS.

MACHINE FOR CUTTING BOOT AND SHOE SOLES.

SPECIFICATION forming part of Letters Patent No. 318,540, dated May 26, 1885.

Application filed January 27, 1881. (No model.)

To all whom it may concern:

Be it known that I, JAMES J. BREACH, of South Weymouth, in the county of Norfolk and State of Massachusetts, have invented certain new and useful Improvements in Apparatus for Grading Patterns, of which the following is a full, clear, and exact description.

This apparatus, for grading patterns and for other like purposes, is designed more especially for the grading of patterns of boot and shoe soles, or, in other words, for the cutting out of boot and shoe soles in their varying sizes, either as to width or length or as to both width and length, from the use of a common pattern-block having the proper shape, both in width and length, for a boot or shoe sole of a size corresponding to such pattern, and for that reason this invention is herein shown and described in reference to such application of it, and although it is so particularly illustrated and described, it is intended to apply it to the grading of all patterns for which it may be found adapted.

This machine is composed, in substance, of the following elements, to wit: first, a horizontal stationary former, in the present instance, of the proper outline of a boot or shoe sole; second, a tracer arranged to travel around and about the periphery or edge of the said sole-former; third, a suitable knife, cutter, or marker; fourth, a cutting block or table; fifth, a clamp for clamping the material to be cut or marked upon the cutting block or table; sixth, mechanism constructed and arranged, first, to produce from the travel or movement of the tracer about the periphery of the sole-former a travel of the cutting-knife or marker in a corresponding outline or direction; and, second, to be capable of an adjustment to secure from one and the same sole-former the cutting out by the cutting-knife of a boot and shoe sole in any one of the varying sizes, either as to length or as to width, or as to both, of boot or shoe soles; seventh, mechanism constructed and arranged, first, to cause the cutting-knife to cut out a boot or shoe sole, in the movement of the cutting-knife, because of its above-stated connection with the travel of the tracer about the sole-former; and, second, to secure a presentation of the cutting-edge of the cutting-knife to the material from which a boot or shoe sole is being cut and at any and all parts of the cutting operation in a line substantially parallel or coincident with the direction of such cut.

These several elements of themselves and in their connection and operation above stated, considered broadly, are substantially embraced in the pattern-grading apparatus shown and described in the schedule annexed to the Letters Patent of the United States issued to me, dated September 16, 1879, and numbered 219,615, and as to these several elements, separately and together, and their construction, arrangement, and connection for operation this invention in substance consists—

First. In the combination, with a stationary sole or other suitable former or pattern and with a tracer adapted to roll or otherwise to have a bearing against the edge of the pattern, of an endless chain, which is connected to the said tracer and is arranged in relation thereto and to the said former in a manner to secure, through the movement of the chain from end to end, the travel of the tracer around and about the entire edge or periphery of the former, and to permit in such travel of the tracer the maintenance of its said bearing upon and against the edge of the former at any and all parts of its length.

Second. Of a stationary sole or other suitable former or pattern in combination, first, with a tracer which is arranged to travel horizontally about and strictly follow the edge or periphery of said former, and in such travel to swivel or turn in a carriage arranged to move horizontally forward and backward in a straight line over and upon a horizontal carriage, which, together with the tracer-carriage, is in turn adapted to move (the two as one) forward and backward in a straight line at right angles to the forward and backward movement of the tracer-carriage over its supporting-carriage aforesaid; and, second, with a horizontal carriage which is adapted and arranged to move, first, in one direction forward and backward in a straight line, and as one with said tracer-carriage and its said supporting-carriage in their conjoined movement, as aforesaid; and to move, secondly, in the other direction forward and backward, in a straight line, and in conjunction with the

tracer-carriage in its movement over and upon its supporting-carriage, and which, for this second movement, is connected in such manner by a pivot to a horizontal radius-bar, in its length pivoted to the tracer-carriage and adapted to play lengthwise through a guide-block, in turn pivoted to the supporting-carriage over and upon which the tracer-carriage moves, that for and during the whole of such forward and backward movement of the tracer-carriage over and upon its supporting-carriage, and of the similar movement of the carriage connected, as aforesaid, through the radius-bar to it, and which moves with it, the relative perpendicular distances between parallel lines drawn parallel with the travel of the tracer-carriage over and upon its supporting-carriage and through the axes of the pivoted connections between said several moving carriages—to-wit, the tracer-carriage, its supporting-carriage, and the carriage then moving with the tracer-carriage in the same direction over and upon the supporting-carriage—and the radius-bar will always remain and be the same. This construction and arrangement and operation of connection between these three several carriages—to wit, the tracer-carriage, the carriage supporting the tracer-carriage, and the carriage adapted to move with the tracer-carriage upon and over the supporting-carriage for the tracer-carriage—in addition to other results, not necessary to now mention, gives and imparts for any and all portions or divisions, and for and during the whole of the length of the movement of the tracer-carriage over and upon its supporting-carriage, a movement to the carriage that, as described, moves with the tracer-carriage in its said movement over and upon its supporting-carriage, a direct and proportionate movement for any and all corresponding portions or divisions and for and during the whole of the length of its said movement in the same direction, and this result is and will be the same whatever is or may be the relative position upon the said radius-bar of the pivoted connections between it and the said several carriages, all substantially as hereinafter described.

Third. Of a stationary sole or other suitable former or pattern, in combination, first, with a tracer, which is arranged to travel horizontally about and strictly follow the edge or periphery of said former, and in such travel to swivel or turn in a carriage arranged to move horizontally forward and backward in a straight line over and upon a horizontal carriage, which together with the tracer-carriage is in turn adapted to move (the two as one) forward and backward in a straight line at right angles to the forward and backward movement of the tracer-carriage upon its supporting-carriage, as aforesaid; and, second, with a horizontal carriage, which is adapted and arranged to move in one direction forward and backward in a straight line and as one with said tracer-carriage and its said supporting-carriage in their conjoined movement, as aforesaid, and to move in the other direction forward and backward in a straight line in conjunction with the tracer-carriage in its movement over and upon its supporting-carriage, and in this latter movement adapted and connected to the tracer-carriage in any suitable manner to secure an increase or decrease in its length relative to the length of the similar movement of the tracer-carriage upon its supporting-carriage; and, third, with a horizontal carriage, which is adapted to move in parallel lines with the movement of the supporting-carriage, and over and upon and also with the carriage connected to and moving with the tracer-carriage in its movement over and upon its supporting-carriage, and which in addition to said adaptation is arranged and connected to the carriage, over and upon and with which it moves, as aforesaid, to receive from the movement of the tracer-carriage with its said connected carriage over and upon its supporting-carriage a forward and backward movement at right angles to such movement of the tracer-carriage and its said connected carriage, and in such manner, relative to the forward and backward movement of the supporting-carriage for the tracer-carriage that, for any and all portions or divisions and for and during the whole of the length of said movement of said supporting-carriage for the tracer-carriage, it shall have imparted or given to it a direct and proportionate movement for any and all portions and divisions, and for and during the whole of its length, all substantially as hereinafter described.

Fourth. In the combination, with carriages arranged and adapted to move as to each other and as to the travel in two directions running at right angles, of a carriage connected to a tracer, which is arranged to travel around and about and to strictly follow the edge or periphery of a stationary sole or other former, all substantially as has been described, of mechanism constructed and arranged in itself, and in its application to the said carriages, to secure through it an adjustment of the aforesaid movements of the said carriages relative to each other and to the travel of the tracer-carriage, all substantially as and for the purpose hereinafter described.

Fifth. Of a cutter-bar which is arranged to move toward and away from a stationary cutting-block, and at its cutting-edge in one of its said movements to travel directly through the thickness of the material placed upon said block, and in the other of its said movements to come out of and wholly clear or pass beyond the thickness of said material, and furthermore is arranged, as it is so reciprocatingly moved, to be carried in a continuous or other line, either by hand or machinery, around and about the plane of said block, in combination with a foot-piece, which in itself is constructed and arranged to continuously rest or press or otherwise drag upon the material as it is so cut by and at and about the aforesaid operation of the cutting-edge of the cutter-bar, and

which, together with the cutter-bar, is relatively so constructed and arranged and applied the one to the other that, as it so rests or drags upon the material being cut by the cutter-bar and as said cutter-bar is being reciprocatingly moved, it will turn said cutter-bar in such manner that said cutter-bar will always present its cutting-edge to the material which it is to cut in a line in substance coincident with the line along which the material is to be cut and at and upon each and every stroke of the cutter-bar against said material.

Sixth. Of a cutter-bar which is arranged to move toward and away from a stationary cutting-block, and at its cutting-edge in one of its said movements to travel directly through the thickness of the material placed upon said block, and in the other of its said movements to come out of or wholly clear or pass beyond the thickness of said material, and furthermore is arranged, as it is so reciprocatingly moved, to be carried in a continuous or other line, either by hand or machinery, around and about the plane of said block, in combination with a foot-piece which in itself is constructed and arranged to enter into and continuously remain in and pass or follow along the line of cut in the material as it is cut by the cutting-bar aforesaid, and at the rear or behind the plane of the cutting operation at any and all strokes of the cutter-bar, and which, together with the cutter-bar, is relatively so constructed and arranged and applied the one to the other that as it so remains in and follows along the line of cut in the material from the cutting operation of the cutter-bar and as said cutter-bar is being reciprocatingly moved it will turn said cutter-bar in such manner that said cutter-bar will always present its cutting-edge to the material which it is to cut in a line in substance coincident with the line along which the material is to be cut and at and upon each and every stroke of the cutter-bar against said material.

Seventh. Of a cutter-bar which is arranged to move toward and away from a stationary cutting-block, and at its cutting-edge in one of said movements to travel directly through the thickness of the material placed upon said block, and in the other of its said movements to come out of and wholly clear or pass beyond the thickness of said material, and furthermore is arranged, as it is so reciprocatingly moved, to be carried in a continuous or other line, either by hand or machinery, around and about the plane of said block, in combination with a foot-piece, which in itself is constructed and arranged to continuously rest or press or otherwise drag upon the material as it is so cut by and at and about the aforesaid operation of the cutting-edge of the cutter-bar, and, as it so rests or presses or drags, to enter into and remain in and pass or follow along the said line of cut and at the rear or behind the plane of the cutting operation at any and all strokes of the cutter-bar, and which together with the cutter-bar is relatively so constructed and arranged and applied the one to the other that as it so rests or presses or drags upon the material being cut by the cutter-bar, and also as it so follows in the line of said cut and as said cutter-bar is being reciprocatingly moved it will turn said cutter-bar in such manner that said cutter-bar will always present its cutting-edge to the material which it is to cut in a line in substance coincident with the line along which the material is to be cut and upon each and every stroke of the cutter-bar against said material.

Eighth. Of a tracer adapted and arranged to travel about and around and in such travel to strictly follow the edge or periphery of a sole or other suitable former, and in itself constructed and arranged in relation to the driving mechanism for such tracer to secure at any given point in its line of movement an automatic stopping of such driving mechanism, and thus the further progress of the tracer, as well, also, as the further movement of the other parts of the machine.

The several recited clauses of this invention hereinabove given cover, in substance, the principal features thereof; but, in addition thereto, this invention also covers many improvements in the details of such mechanism and in other mechanism appertaining thereto and to the successful operation of a machine for grading patterns, all of which will hereinafter fully appear.

In the accompanying plates of drawings the present improved apparatus for grading patterns is illustrated.

In Plate 1, Figure 1 is a plan view. In Plate 2, Fig. 2 is a front elevation with the front side of the supporting frame-work of the machine removed. In Plate 3, Fig. 3 is an elevation of the left-hand end of the machine; Fig. 4, a transverse vertical section and elevation at the right-hand end of the machine. In Plates 4 and 5, Figs. 5 to 29, inclusive, are respectively views in detail, the character of which will appear in the detailed description of this machine which hereinafter follows. In Plate 6, Figs. 30 to 33, inclusive, are several views, respectively in plan, side elevation, and cross-sections in relation to certain parts of the machine, as will hereinafter fully appear.

In the drawings, A represents a horizontal rectangular-shaped metal frame, which is supported at each corner by a leg, B, and makes the supporting frame-work of the machine. C is the driving-shaft. This driving-shaft extends horizontally across the frame A from front to rear, turns in suitable bearings thereof, and at its rear end, outside of the frame A, it is provided with a loose driving-pulley, D, which is adapted to slide upon the shaft, and has its hub *a* constructed with teeth and recesses *b*, to be clutched, with a correspondingly toothed and recessed hub, *c*, of a pulley-wheel, E, which is made fast to the driving-shaft. The hub *a* of the driving-pulley D has

a peripheral groove, *d*, which receives the forked end *e* of an angular lever, F, having a fulcrum, *f*, at the rear side of the frame A. This lever F swings horizontally upon its fulcrum *f*, and projecting toward the front side of the frame it is there connected by a cord, *g*, which passes over a guide-pulley, *h*, to a lever-handle, G, located at the front side of the machine and there arranged to secure, by a downward pull upon it, acting through its said connection with the angular lever F, a slide of the loose driving-pulley D, into an interlock and clutch with the fixed pulley E of the driving-shaft C, and thereby a connection of driving-pulley and driving-shaft. This clutching of the loose and fixed wheels D E is made against a spring, *i*, Fig. 25, Plate 5, which at one end is connected to the angular or clutching lever F and at the other end to the frame A in a suitable manner, to so act, and when the clutch is made it is maintained by the side rest of the clutching-lever at its front end, *j*, against a stationary shoulder, *k*, of the frame A, suitably located therefor. On the release of the clutching-lever F from its shoulder-rest *k*, which is accomplished by a downward pressure or pull upon it, the reaction of its spring *i* throws the lever F in the proper direction to slide the loose driving-pulley D out of clutch with the fixed pulley-wheel E.

The driving-shaft C, Figs. 2 and 4, within and near the front rail of the frame A, has a bevel gear-wheel, H, which meshes into a horizontal bevel gear-wheel, I, at the lower end of a vertical shaft or stud, *l*, arranged to turn in a bearing-block, *m*, of a fixed horizontal bed piece or block, J, in the right-hand corner of the frame A. This stud *l* projects above the block J, and at its upper end it has a horizontal sprocket-wheel, *n*, Fig. 2, partially surrounded by an endless chain, K, which, passing to the right, partially surrounds a similar horizontal sprocket-wheel, *o*, arranged to turn upon a vertical stud, *p*, secured at its lower end in the bed-piece J, and at its upper end in a stationary horizontal plate, *q*, Fig. 6, Plate 4, having on its upper side a rigidly-attached form-plate, L, or "sole-former," as it will be hereinafter called, having the outline of a boot or shoe sole, and shown separately in Fig. 12, Plate 4.

The endless chain K, under the connection above described, travels from end to end and about the outline of, but in a horizontal plane below, the edge or periphery *r* of the sole-former L, and, Fig. 21, Plate 5, it is connected through a horizontal link, *s*, which at one end is pivoted to one end of a chain-link and at the other end similarly is pivoted to a horizontal carriage, M, which carriage, as a whole, is to be called hereinafter the "tracer" of the machine.

As particularly shown in Fig. 22, Plate 5, the bearing-block *m* for the vertical stud *l* of sprocket-wheel *n* at one end of endless chain K is within an opening, *t*, in the bed-piece J of frame A, and at its ear-pieces *u*, by slots *v* and set-screws or bolts *w*, it is secured to the said bed-piece. These slots *v*, as also the opening *t* in bed-piece J, run in the direction of the length of the travel of the endless chain K from end to end, and through them and the set-screws *w* the said bearing-block *m* is adapted to be adjusted in position, as desired, to take up the slack, if any, in the endless chain.

The bearing-stud *p* for the sprocket-wheel *o* rests by a collar, *x*, Fig. 22, Plate 5, on the bed-piece J, and then passes through a slot, *y*, of the bed-piece J, running in the direction of the length of the travel of the endless chain K, and below said bed-piece it is secured in place by screwing its screw-nut *z* firmly against the under side of said bed-piece. This arrangement of parts enables the sprocket-wheel *o* to be adjusted in position relative to the working of the endless chain K and its other sprocket-wheel, *n*.

The tracer M (see Figs. 15 and 19, Plate 5) below its link-connection with the endless chain K, as above described, has two horizontal friction-rollers, *a' a'*, which are placed side by side in a position to bear against the upright inside face, *b'*, of a raised edge, *c'*, of the stationary block J and for the concentric flanges *d'* of the rollers *a'* to enter into the groove *f'* under the horizontal shoulder *g'* below and surrounding the said bearing-face *b'* for the rollers *a'*. This raised edge *c'* is a continuous one, and it is in the general outline of a boot or shoe sole, and the tracer, as it is carried around by the travel of the endless chain K, moves and runs by its friction-rollers *a'* in contact with the said inner face, *b'*, of said raised edge *c'*, and it is held from vertical escape by the under lap of the concentric flanges *d'* about said rollers *a'*.

The tracer M (see Fig. 6, Plate 4) in its travel, as aforesaid, rests and travels through a friction-roll, *h'*, upon and against the edge *r* of the sole-former L. This friction-roll *h'* swivels upon a horizontal plate, *i'*, Fig. 20, Plate 5, arranged in guideways *j'* of the tracer to slide toward and away from the edge *r* of the sole-former L.

k' is a spring, Figs. 15 and 20, Plate 5, applied to and between the tracer-slide *i'* and the tracer M in a manner to always press the said tracer-slide toward the periphery of the sole-former and thus to hold its friction-roll *h'* in close contact therewith, and also to always press the tracer-carriage upon which the said tracer-slide moves away from the periphery of the sole-former, and thus to hold its friction-rollers *a'* in close contact with its bearing-face *b'* of the edge *c'*, against which they run. The spring *k'* is coiled about and attached to a post, *l'*, which is adapted to turn in the bottom plate of tracer and has a fixed radial arm, *m'*. The free end of spring *k'* lies and presses against the friction-roll *n'* of the tracer-slide *i'* in a direction toward the edge of sole-former, and again, the spring, through its post *l'* and the arm *m'* to such post, lies and presses

against a stud, o', of the bottom plate to tracer in an outward direction from the edge of sole-former, and thus the tracer is held to its bearings as aforesaid.

The tracer M, constructed in itself and connected to the endless chain K and arranged about the sole-former, as above described, under the travel of the chain, is made to move around the sole-former, and, as it so travels, to follow the outline or periphery r thereof. The tracer, in its travel aforesaid, rests upon the upper face of the raised edge c', before referred to, and an outside raised edge, p', also of the general outline of the sole-former, and thus is kept in a horizontal position. (See Fig. 6, Plate 4, and Fig. 15, Plate 5.) The tracer is provided with a fixed downwardly-projecting stud, q', Fig. 6, Plate 4, which is so situated that in the travel of the tracer it will pass over, and as it so passes over will press downwardly upon the upper rounded end of a vertical stud, r', Fig. 6, Plate 4, and Fig. 26, Plate 5, which is shouldered in its length and is arranged at the right-hand end of the bed-piece J, in a socket of such bed-piece in a position to rest upon the angular clutching-lever F, hereinbefore referred to, when such lever is in its before-described locked position of clutch, as shown in Figs. 25 and 26, Plate 5. This downward pressure upon the stud r' by the travel of the tracer-pin q' over it, as above described, causes the stud r' to throw such clutch-lever out of its rest against the shoulder k and to place it in position to be thrown by the reaction of its spring i in the proper direction to unclutch the loose and fixed pulleys D E of the driving-shaft C, and thereby automatically stop the further movement of the tracer and all of the other operating parts of the machine, as will hereinafter more fully appear.

The tracer-slide at its end toward and which is just above the sole-former L, is connected by a vertical swivel-pin, s', Fig. 6, Plate 4, to a slide or carriage marked with the figure 1, and to be hereinafter called "carriage 1" or "tracer-carriage," and appears illustrated in Figs. 1 and 2, and Fig. 6, Plate 4. This tracer-carriage 1 is arranged to travel upon and horizontally along the length of the dovetail rail t' that runs lengthwise of a horizontal frame or carriage, marked with the figure 2, and to be hereinafter called "carriage 2," and in a parallel line or direction with the longer axis of the sole-former L, and this carriage 2, of which said dovetail rail forms a part, is supported by rollers or wheels u' upon transverse parallel guide-rails v' of the frame A, and it is arranged and adapted to travel on said rails at right angles to, or, in other words, directly across the line of travel of carriage 1 upon carriage 2. There are three of these guide-rails v', one at each end of the frame A and one between them. This intermediate rail (see Fig. 18, Plate 5) has its opposite upright sides or faces w' beveled, and each wheel which travels on said rail has a flange, x', which, on its inner face, y', is beveled, and by such flanges the said wheels bear and roll against the beveled sides of the rails, and otherwise they have no rest thereon. The axial-pin z' of each of these flanged wheels u' is secured in place by a screw-nut, a^2, and it has a shoulder, b^2, which, on suitably screwing up the pin z', can be made to press against one side of its wheel, and thereby force the wheel at its opposite side into close contact with the support for such pin z' of such side. By this means the travel of carriage 2 on its guide-rails is rendered steady and firm against any movement end to end upon the frame A.

N is a horizontal traverse or radius bar, Figs. 1, 2, and 4 and Fig. 6, Plate 4, secured by a pivot, c^2, to tracer-carriage 1. This pivot c^2 of the radius-bar N to carriage 1 is coincident with the central line of the radius-bar along its length, and this radius-bar back of tracer-carriage 1 is adapted to move lengthwise through a dovetail slide or clasp, d^2, which is axially or centrally pivoted at e^2 (see Figs. 1 and 24) to a stationary block, f^2, of a stationary rail, g^2, of carriage 2, which rail runs in a line at right angles to the line of travel of carriage 1 upon carriage 2, or, in other words, at right angles to the longer or longitudinal axis of the sole-former L, and is otherwise so situated that a line drawn through the center of said axial pivot e^2 to carriage 2 and said axial pivot c^2 of radius-bar to tracer-carriage 1 at right angles to the said longer axis of the sole-former L will intersect such axial line of sole-former midway of its length.

The stationary block f^2 is fastened to its carrying-rail g^2 by a set-screw, h^2, and with this set-screw loosened the position of the block f^2 on its carrying-rail g^2 may be changed at pleasure by simply sliding the block f^2 upon the same, (for which purpose the block f^2 and rail g^2 are suitably constructed,) and then tightening the said set-screw h^2 against the rail. This adjustment of the block f^2 upon its rail g^2, as shown, is such that the distance between the center or axis of the pivot-connection e^2 for the slide-clasp d^2 of radius-bar N, and the center or axis of the pivot-connection c^2 between said radius-bar and carriage 1 equals the length of the longer axis of the sole-former L when the central longitudinal line of said radius-bar N is at right angles to the longer or longitudinal axis of the sole-former.

The radius-bar N has a dovetail slide or clasp, i^2, adapted to slide along its length, and connected by a vertical axial pivot or swivel, j^2, to the apex or angle k^2 of a horizontal triangular frame, O, which makes one end of a carriage, marked with the figure 3, and to be called hereinafter "carriage 3." This carriage 3 is arranged to travel upon carriage 2 in the direction of its length—that is, in a direction parallel with the direction of the travel of tracer-carriage 1 upon the rail t' of carriage 2.

The horizontal frame O, which makes one end of carriage 3, and through which such carriage 3 is connected to slide i^2 of radius-bar N,

as has been above described, is arranged by its side rail, P, opposite to its apex or angle k^2, at which the said described connection is made to be capable of being moved forward and backward within a dovetail groove, Q, of carriage 3, which groove runs at right angles to the said line of travel of carriage 3 upon carriage 2, or, in other words, in a line parallel with the line of travel of carriage 2. This forward and backward movement of the triangular frame O upon its carriage—to wit, carriage 3—is obtained through a toothed or rack bar, l^2, rigidly attached, by slots m^2 and set-screws n^2, Fig. 1, and Figs. 23 and 27, Plate 5, to the triangular frame in a parallel direction with the line of said movement in combination with a horizontal gear-wheel, o^2, which is in position to engage with said rack-bar l^2, and is attached to a vertical shaft, p^2, arranged to turn at its lower end in a bearing of carriage 3, and at its upper end in a bearing of the head R to a fixed goose-neck standard, S, of said carriage 3, Figs. 2, 3, and 4, and Fig. 13, Plate 4. This gear-carrying shaft p^2 has a horizontal and open hand-wheel, T, for turning it, and thus through its gear connection with the triangular frame O secure the movements described of said frame upon and along its guide-groove Q of carriage 3, and this movement may be either to the right or left in relation to the direction of such groove, according as may be described. This movement of the triangular frame upon carriage 3 enables the position of its pivotal connection j^2, and thus of carriage 3 with the radius-bar N, to be changed in relation to the length of such bar, for an object and purpose which will hereinafter fully appear.

In addition to this mode above described of changing the position through the triangular frame of the pivotal connection j^2 of carriage 3 with radius-bar N, the triangular frame is adapted, on the release of the set-screws n^2, which confine its rack-bar l^2 to it, to be moved along the length of such rack-bar in its guideway Q of carriage 3 to again change the position of the pivotal connection j^2 of carriage 3 relative to the length of the radius-bar N. This adaptation is illustrated in Figs. 23 and 27, Plate 5, of the drawings, and it consists of a screw-pin, q^2, having two shoulders, r^2, in its length and a screw-threaded end portion, s^2. This pin at its shouldered portion r^2 turns loosely within a suitably-constructed bearing for it of the triangular frame O, and enters by its screw-threaded end s^2 into a screw-threaded socket in one end of the rack-bar l^2, all so that the axial line of the screw-pin is in a line coincident with the length of such bar, or, in other words, with the direction of movement of the triangular frame in its guideway of carriage 3.

With the set-screws n^2, which confine the rack-bar l^2 to the triangular frame loosened as to such confinement, the then turn of the screw-pin q^2 either to the right or left carries with it the triangular frame for the reason that the rack-bar l^2 cannot move because of the engagement of its teeth with the gear-wheel o^2, which, as will hereinafter appear, is held against turning, and thus the pivotal connection of such frame in relation to the length of radius-bar N is correspondingly changed and there secured against movement by tightening up the said set-screws. This changing of the position of pivotal connection of carriage 3 with radius-bar N is independent in every respect of the change of the position of the same pivotal connection secured through the rack-bar and its gear-wheel o^2, and it is for a purpose to be hereinafter described.

t^2 is a series of notches at equal distances apart along a portion of the periphery of the hand-wheel T, and u^2 a spring pin or catch, Fig. 13, Plate 4, which is arranged to play horizontally in a suitable guideway of the goose-neck standard S, and is located in a suitable position and manner to engage with such notch of the series of the notches t^2 of the hand-wheel T as may be placed opposite it through the turning of said hand-wheel. This engagement between the catch-pin u^2 and a notch t^2 of the hand-wheel T, while such engagement continues, holds the wheel stationary, and consequently it similarly holds the triangular frame O stationary and against movement upon carriage 3; but when such engagement is released or broken, by withdrawing the catch-pin u^2, (for which purpose it is provided with a lever-handle, U, Figs. 1, 2, 3, and 4, and Fig. 13, Plate 4, which is hung to the goose-neck standard S,) the hand-wheel is then free to be turned to slide the triangular frame O upon carriage 3, as before stated.

The periphery of the hand-wheel T at and along the length of the notches thereon is marked at equal distances apart with figures that commence at the right with figure 10, and proceed toward the left in regular order and succession to and including figure 13, and thence continuing toward the left again in regular order and succession with figure 1 to figure 13, inclusive, and this placing of these figures upon said hand-wheel, as aforesaid, is such that when any one of the same is at the point v^2 of the index finger piece w^2, Fig. 1, fixed upon the left-hand side of the goose-neck standard S, a notch, t^2, of the hand-wheel will be in position for the engagement of the stop-pin u^2 therewith, and such a notch that in the then operation of this machine the sole cut out will be of a length belonging to such number, and of a proportionate width through its whole length corresponding to such length of the sole, and therefore in the use of this machine this relative notching and figuring of the hand-wheel represents or stands for the varying sizes of boot and shoe soles, both as to their length and width, all as will hereinafter be fully described, and thus more fully appear.

In Fig. 4 and Fig. 13, Plate 4, x^2 is a sleeve which surrounds and turns upon the hand-

wheel shaft p^2 below its hand-wheel. This sleeve is provided with a handle-lever, V, Figs. 1, 2, 3, 4, and Fig. 13, Plate 4, which passes up through the open hand-wheel, and thence over the upper side of the wheel, where it is provided with a spring-lever catch, y^2, adapted to engage with a notch of a series of notches, z^2, arranged at equal distances apart for a portion of the periphery of the hand-wheel, and for that portion thereof not covered by the notches t^2 and figures before described. These latter notches z^2 have figures placed against every other one—to wit, against the right-hand notch two zeros (0 0) the second notch to the left of that one zero (0) and the figures from one (1) to seven, (7,) inclusive. In the use of this machine this numbering of the hand-wheel represents or stands for the varying widths of boot and shoe soles, all as will hereinafter be fully described and thus fully appear. This sleeve x^2 of the hand-wheel shaft p^2 carries a horizontal gear-wheel, a^3, arranged to mesh into a horizontal toothed or rack bar, b^3, Figs. 1 and 2, which is secured to a plate-slide, W, arranged to move in a dovetail groove or way, X, of carriage 3 in a line parallel with the travel of carriage 3 upon carriage 2, as has been herein described.

The turn of the gear-wheel a^3 through the swing of the lever-handle V, independent of the hand-wheel upon the rack-bar b^3 of the plate-slide W, either to the right or left in relation to the length of such rack-bar, moves in each case the plate-slide W in and along its guideway X in the corresponding direction, while the handle end of the lever moves in the reverse direction. The position of plate-slide W in its guideway is thus changed or adjusted, and with the lever-handle V then engaged with a tooth, i^2, of a series of teeth upon the hand-wheel provided for its engagement therewith will be so maintained and held, except it be changed, as hereinafter stated.

The turn of the gear-wheel o^2 through the hand-wheel, either to the right or left upon the rack-bar l^2, which is adapted to slide across carriage 3, moves said rack-bar and with it the triangular frame-connection O in a corresponding direction, and if the lever-handle V be engaged with the hand-wheel the gear-wheel a^3 connected with it will also be turned upon its rack-bar b^3 in a corresponding direction, and thus the plate-slide W moved in its guideway relative to the length of such guideway in a corresponding direction—that is, to the right, if the hand-wheel is turned to the right, and to the left, if the hand-wheel is turned to the left.

The moving of the handle-lever V either to the right or left moves only the plate-slide W, and this movement of the slide is in each case the reverse in direction to that of the handle-lever.

The swing of the hand-wheel to the right or left moves not only the frame-connection O across carriage 3 either to the right or left, as the case may be, but also the plate-slide W to the right or left, as the case may be, these respective movements being at right angles to each other.

In the operation of this machine a change of position of the plate-slide W upon the carriage 3 through the handle lever V affects the sole being cut in relation to its width only, and a change of position of the frame-connection O upon carriage 3 through the hand-wheel affects the sole being cut in relation to its length; but as when such change is made the plate-slide W is also moved by such movement of the plate-slide. The sole being cut in its width is also affected proportionately to the change in its length and whatever may be the change in width made by a change of position of the plate-slide through the handle-lever, all as will appear more fully hereinafter. This plate-slide W has a horizontal traverse or radius bar, Y, Figs. 1, 2, 3, and 4, and Fig. 7, Plate 4, pivoted or swiveled to it, and the axis c^3 of such pivot is coincident with the central longitudinal line of said bar. This radius-bar Y in its length is provided with two dovetailed clasps, d^3 f^3, Figs. 1 and 2, and Fig. 7, plate 4. The clasp f^3 is adjustable as to the length of the bar Y, and when so adjusted is secured by set-screws g^3, and the clasp d^3 is free for the radius-bar Y to slide within and through it, and is concentrically pivoted to the front end of a carriage, marked with figure 4, and to be hereinafter called "carriage 4," Figs. 1, 3, and 4, and Fig. 7, Plate 4. This carriage 4 carries a cutter-bar, as will hereinafter appear, and is arranged to slide within a dovetail way, Z, of carriage 3 in a line at right angles to the line of travel of carriage 3 upon carriage 2; or, in other words, in a line parallel with the line of travel of carriage 2 upon the frame A.

The adjustable and fixed clasp f^3 of the radius-bar Y is concentrically swiveled at z^6 to a slide-block, l^3, Fig. 1 and Fig. 5, Plate 4, adapted to move upon a horizontal rod, m^3, of a frame, A^2, arranged to travel in conjunction with carriage 3; but in such travel to move along and upon the length of a stationary horizontal guide-bar, B^2, Fig. 1 and Fig. 7, Plate 4, of the supporting-frame A of the machine in lieu of along and upon the length of carriage 2, as is the case with carriage 3. This guide-bar B^2 is underneath carriage 3, while the frame A^2, which acts as a guide to the longitudinal slide of the clasp f^3 on radius-bar Y, is above carriage 3, and the said connection of such frame A^2 with its said guide-bar B^2, which has been described, is made by a downwardly-projecting arm, C^2, Fig. 1, of the frame A^2, which arm passes through a slot, n^3, in carriage 3, having the proper direction and length for the movement of carriage 3 across carriage 2, as described. This attaching-arm C^2 of the frame A^2 has a friction-wheel (not shown) bearing against each side of the carriage-slot n^3, and above carriage 3 the frame has a friction-roller, o^3, which bears upon

one side of the guideway Z to carriage 4. This guiding-frame A^2 is stationary in relation to the herein-described travel of carriage 2, but moves, in conjunction with carriage 3, on carriage 2.

Carriage 4, (more particularly shown in Fig. 7, Plate 4, although in some respects shown in Figs. 1, 2, and 3,) has a standard, D^2, carrying in its upper part a short horizontal shaft, p^3, which is in a parallel line with the movement of said carriage 4 upon its guideways Z, and at its rear end is connected by a universal joint, E^2, to one end of a horizontal connecting-rod, F^2, made in two parts telescoped together and longitudinally splined, and at its rear end connected by a universal joint, G^2, to the journal of a small pulley-wheel, H^2, arranged to turn in bearings of the stationary bracket I^2 of the frame A, and to be driven by a belt, J^2, from the revolution of the fixed pulley E, hereinbefore referred to, of the driving-shaft C.

The driving-belt J^2, (see Figs. 28 and 29, Plate 5,) is provided with a line of eyeleted holes, q^3, at equal distances apart, and by these holes the belt engages with radial pins r^3 of its pulley-wheels E H^2, located therefor at suitable distances apart. (See Figs. 1, 2, 3, and 4.) This connection, through universal joints E^2 G^2 and longitudinally-splined connecting-rod F^2 of the horizontal shaft p^3 with the driving mechanism above described, secures the revolution of such shaft p^3 in any and all movements of carriage 4 in its guideway Z, and of carriage 4 with carriage 3 upon and along carriage 2.

As shown in Fig. 7, Plate 4, more particularly, the horizontal shaft p^3 of carriage 4 has a vertical gear-wheel s^3, with which meshes a smaller gear-wheel, t^3, carried by an upright support, w^3, which is arranged for an up and down movement upon carriage 4, and in such movement to be guided both by a vertical guide-post, v^3, of the upper side of the carriage 4, and by the vertical and under tubular extension w^3 of the support, which passes through a guide-tube, x^3, projecting downwardly from the under side of carriage 4.

The downward movement of the gear-wheel support w^3 places its gear t^3 into connection with the gear-wheel s^3 on carriage 4, and such connection is maintained by the interlock of a spring-bolt, y^3, upon carriage 4 with a notch in said support, and said downward movement is against a horizontal spiral spring, z^3, connected at one end to the rear end of carriage 4, and at the other end through a line or chain, a^4, passing over a pulley, b^4, of carriage 4 to an ear-piece, c^4, of tubular extension w^3 to the gear-support w^3, which ear-piece c^4 is arranged to move in a vertical guide-slot, d^4, of the under tubular bearing, x^3, for the under tubular extension w^3 of gear-support w^3.

The upward movement of the gear-support w^3 is with the reaction of its spring z^3, and occurs immediately upon the release of the holding spring-bolt y^3, which, for convenience for such release, is provided with a suitable lever-handle, g^4, Fig. 1, and this upward movement is limited by a screw-nut or collar, e^4, of the guide-post v^3, against which abuts the foot-piece f^4 to the gear-support w^3.

The gear-wheel t^3 of the vertical moving support w^3, above described, is eccentrically pivoted to the upper end of a vertical connecting-rod, h^4, which, at its lower end, is pivoted to a collar, i^4, that enters into and moves within a vertical guide-slot, j^4, of the gear-support w^3, and is secured by a set-screw, k^4, to a cylindrical rod, l^4, placed within the downward tubular extension w^3 of the gear-support w^3 in a manner to be alternately moved up and down therein under the rotation of the gear-wheel t^3, to which it is eccentrically connected, as above described. As shown particularly by Figs. 8, 9, 10, and 11, Plate 4, this vertical reciprocating rod l^4 has swiveled in its lower end a vertical cutter-bar, m^4, which continues downward through the guide-tube w^3 for such rod, and projects at the lower end thereof, where it enters and passes through a foot-piece, n^4. This foot-piece n^4 by its sleeve-portion o^4 turns around and plays vertically within the guide tube w^3, and in its upward play it works against a spiral spring, p^4, which surrounds the outside of said guide-tube, and is there confined endwise between a shoulder, q^4, of the guide-tube and a collar, r^4, of the foot-piece which loosely surrounds said guide-tube, and said foot-piece is held against escape from the guide-tube under the downward pressure of the spring p^4 by the abutment of its said collar r^4 against a shoulder, s^4, at the extreme lower end of the guide-tube.

The cutter-bar m^4 at its lower end (projecting end) has a square cutting-edge, t^4, and the portion of the cutter-bar which plays through the foot-piece and its tubular portions o^4 as the cutter-holder is reciprocated, as aforesaid, is flat-sided, and its guide-hole in the foot-piece is correspondingly shaped.

The under face of the foot-piece is flat, and it has an edge lip, u^4, which runs in a line coincident with the line of the straight cutting-edge t^4 to the cutter-bar m^4, and furthermore is at the rear of, or, in other words, behind the cutting-edge in its travel to cut a sole, and in such position situated to follow and travel in the line or slit of the cut made by the cutting-knife, all as and for a purpose as will hereinafter more fully appear.

K^2 is a flat rectangular wooden block. (See Figs. 1, 2, and 3, and Fig. 14, Plate 4, and Fig. 15, Plate 5.) This block K^2 is secured within a pan-shaped metal platen, L^2, by a series of set-screws suitably arranged to be screwed up against the sides of the wooden block, and to thereby secure the block firmly within and to the platen. The wooden block K^2 thus secured projects above the sides of its platen L^2, and it is placed below the cutter-bar m^4, (see Figs. 2 and 3, and Fig. 15, Plate 5,) before referred to, with its flat exposed

surface uppermost and horizontal, and in this position it is secured by a set-screw to the upper end of a vertical post, M^2, secured at its lower end to a stationary rail, N^2, which crosses from the front to the rear of the frame A, and is securely fastened at each end to such frame. This platen-carrying post M^2 is provided with a screw-nut, O^2, directly under the platen L^2, and by turning this nut when the set-screw which confines the platen to the post is loosened the platen can be adjusted in its height, and thus through it the upper and exposed surface of the wooden block adjusted as to its height or horizontal plane. The cutter-bar m^4 in its vertical reciprocating movement cuts against the wooden block K^2, and the horizontal location of this cutting-block is such that when the driving mechanism for the cutting-bar—to wit, the gear-wheels s^3 t^3—is placed in connection, as described, the cutting-edge t^4 of the cutter-bar m^4 in its downward stroke will certainly strike and cut against it. The cutting-block K^2, furthermore, is of such shape and size and its said suspension below the vertical plane of operation of the cutter-bar m^4 is such as to present a surface for the cutter-bar to cut against in any and all positions of the cutter-bar under the operation of this machine, as will hereinafter fully appear. The leather from which a boot or shoe sole is to be cut is placed upon this cutting-block K^2, and there it is clamped by mechanism to be now described, reference being had more particularly to Figs. 1, 2, 3, and 4, and Fig. 14, Plate 4, and Figs. 15, 16, and 17, Plate 5.

P^2 is a vertical bracket of U shape. This U-bracket has its arms horizontal and one above and the other below the cutting-block, and it turns by its lower arm upon the cutting-block post M^2 as a center, which arm is also arranged to be moved up and down upon such post.

The downward movement of the U-bracket is secured by the depression of a treadle-lever, Q^2, to which a vertical rod, R^2, is connected that at its upper end is connected to a horizontal cross-piece, S^2, of two parallel vertical guide-rods, v^4, arranged to pass loosely through the cross-rail N^2 of the frame A, and at their upper ends to enter into a peripheral groove of the bearing portion x^4 of the U-bracket around the cutting-block post M^2.

The downward movement of the U-bracket above described is against a vertical spiral spring, y^4, secured at one end to the parts connected to the treadle-lever, as above described, and at the other end to the cross-rail N^2 of the frame A.

The upward movement of the U-bracket is with the reaction of said spring y^4, and this reaction of the spring, except when so desired, is prevented by catching the treadle-lever Q^2 in a notch or under a shoulder, z^4, of a stationary post, T^2, suitably located therefor.

The upward movement of the U-bracket is limited by the position of the screw-nut O^2 upon the screw-threaded portion of the platen-post M^2 between the platen and the under arm of the bracket, and this upward movement may be increased or decreased within given limits by a simple vertical adjustment of such nut upon said platen-post.

The U-bracket in its arms is a sufficient length that, being swiveled to the cutting-block post M^2, as above described, and swung about such post as a center, it will clear the sides and ends of the cutting-block and its platen or holder.

The upper arm of U-bracket, and which is above the cutting-block, carries a horizontal flat clamping-plate, U^2, of the general outline of a boot or shoe sole, but smaller in all directions than any boot or shoe sole to be cut in the machine when such clamping-plate is used. This clamping-plate U^2 is between the cutting-block K^2 and the arm of the U-bracket which carries it, and its upper side has a transverse dovetail groove, a^5, (Figs. 16 and 17, Plate 5,) and by this groove it is applied to a corresponding dovetail block, b^5, swiveled at x^6, to turn horizontally upon the upper arm of the U-bracket, and provided with a notch, c^5, at one end in a position to receive a pin, d^5, at one end of said groove a^5. This connection of the clamping-plate U^2 to the upper arm of the U-bracket allows the plate to be horizontally swung thereon, and in addition to this attachment the clamping-plate has a further connection between it and the U-bracket through a notch, e^5, Fig. 17, Plate 5, in a transverse raised edge, f^5, of the clamp-plate U^2, and an interlocking horizontal bolt, g^5, of the U-bracket, which bolt is pivoted to the upper end of a vertical lever, V^2, Fig. 2, arranged against the outside of the vertical portion of the U-bracket, and there adapted at its lower outside edge, h^5, to engage with a notch, i^5, in the cross-rail W^2 of the frame A.

The engagement of lever V^2 with frame A, and of its bolt g^5 with clamp-plate U^2, above described, is maintained by the pressure of a spring suitably arranged and applied therefor between it and the U-bracket, and by releasing the pressure of this spring the said engagement of lever and its bolt g^5 both with the frame A and the clamp-plate U^2 is broken. The engagement of bolt g^5 and clamp-plate U^2, above described, holds the clamp-plate against turning at its swivel x^6 upon the U-bracket, and the engagement of lever V^2 with rail W^2 secures the U-bracket against swinging upon the supporting-post M^2 of the cutting-block K^2, and this latter fastening of the U-bracket is toward the position of the sole-former L of the machine.

The height of the U-bracket above the cutting-block both when out and in clamp, and the height of the cutter-bar m^4 and its foot-piece n^4, when the gear-wheels s^3 t^3 for driving and reciprocating the cutter-bar are out of connection, are such relatively that the cutter-bar and foot-piece will be above and entirely clear of the upper edge of the U-bracket.

X^2 is a treadle-lever, Fig. 2, connected by a line, j^5, to the U-bracket. This line j^5 for a portion of its length is made longitudinally elastic by means of an intermediate connected spiral spring, k^5, and it passes over a guide-pulley, l^5, of the frame A, Fig. 15, Plate 5. This intermediate spring-connection between the treadle-lever X^2 and U-bracket is such that a downward pressure upon the treadle will elongate such spring k^5, and secure by its reaction the forward swing of the U-bracket when the lever-catch V^2 that holds it is released. This forward swing of the U-bracket is limited by a cord, m^5, Fig. 15, Plate 5, connecting it to the rear side of the frame A. This treadle-lever X^2 inside of its connection, above described, is also connected by a line, n^5, Fig. 2, to a vertical angular spring-lever, Y^2, arranged to turn upon a fulcrum of the cross-rail W^2 of the frame A. This angular lever Y^2 has a horizontal bolt, o^5, pivoted to it, and this bolt is arranged to play through the said cross-rail W^2 in a manner to abut and press against the lever-catch V^2, which fastens the U-bracket to said cross-rail, when said angular lever, through the treadle X^2, is turned against its spring y^6, and thus to press such lever-catch in the proper direction to release it from its hold of the U-bracket, which then, by the reaction of the spring k^5, before described as forming a part of the connection between it and the treadle-lever X^2, swings toward the front of the machine.

In a machine constructed as above described, through the revolution of the driving-pulley D, if clutched to the driving-pulley E of the machine, the tracer M is carried around and about, strictly following the edge r of the sole-former L, and the cutter-bar m^4 is reciprocatingly moved up and down in relation to the cutting block or platform K^2. In all the lines and directions of this travel of the tracer M, which are parallel to the longer axis of the sole-former L, the tracer-carriage 1 similarly moves upon its guide-rail t' of carriage 2 and through the radius-bar connection N of carriage 2, with carriage 3, and through the location of carriage 4 or cutter-bar carriage on carriage 3, carriages 3 and 4 are moved in unison in a direction corresponding to the said direction of travel of the tracer-carriage 1 upon carriage 2. Again, in all the lines and directions of this travel of the tracer M, which are at right angles to the longer axis of the sole-former L, tracer-carriage 1 operating upon carriage 2 forces such carriage in a corresponding direction on the frame A, and as carriages 3 and 4 are both upon carriage 2, such carriages are carried in a corresponding and equal direction, so far as such transverse movement of carriage 2 of itself is concerned. As to this longitudinal travel of tracer-carriage 1 on carriage 2, if the distance between the pivotal points c^2 e^2 of connection of radius-bar N to carriages 1 and 2, when such pivotal points of connection are in a line running at right angles to the longer axis of the sole-former L, be equal to the length of such longer axis of the sole-former, and if the pivotal point of connection j^2 of carriage 3 with said radius-bar N be adjusted and set through the turning of the hand-wheel T, as has been described, so as to be coincident with the pivotal connection c^2 of radius-bar N with tracer-carriage 1, then the travel of carriage 3 upon carriage 2 in the corresponding direction of the travel of tracer-carriage 1 on carriage 2 is exactly equal in length to the travel of the tracer-carriage 1 on carriage 2; or, in other words, exactly equal in length to the longer axis of the sole-former L, and as a consequence the cutter-bar m^4 will be carried in a corresponding direction exactly equal to the length of the sole-former. Now, if this coincident relation of the pivotal connections c^2 j^2 of carriages 1 and 3 be changed by adjusting and setting through the hand-wheel T, as described, the pivotal connection j^2 of carriage 3 on radius-bar N, so that its distance from the pivotal connection e^2 of carriage 2 on radius-bar N shall be greater or lesser than the distance of the pivotal connection c^2 of carriage 1 on radius-bar N therefrom, then the travel of carriage 3 upon carriage 2 in the corresponding direction of the travel of tracer-carriage 1 on carriage 2, if such distance be greater, will be increased, and if such distance be lesser, decreased, in length as to the length of travel of tracer-carriage 1, and as a consequence the cutter-bar in its movement in a similar direction will be correspondingly affected, and thus be made to pass over a greater or lesser distance, as the case may be, than the whole length of the sole-former.

In all the movements of carriage 3 above described, in reference to the line of travel of tracer-carriage 1 upon carriage 2 the travel of the pivotal point j^2 of connection of carriage 3 on radius-bar N is always in a line parallel to the line of travel of the tracer-carriage 1 on carriage 2; or, in other words, in a line parallel with the longer axis of the sole-former L, and, furthermore, whether its adjustment, as aforesaid, be at a greater or a lesser distance from the pivotal connection e^2 of radius-bar N on carriage 2 than the distance of the pivotal connection c^2 of tracer-carriage 1 on said radius-bar N therefrom, the pivotal connection j^2 of carriage 3 with radius-bar N in the whole length of its said travel is always at the same relative perpendicular distance from pivotal connection c^2 of radius-bar N to tracer-carriage 1, and also from the pivotal connection e^2 of radius-bar N to carriage 2, and thus at any and all portions and for the whole length of the movement of the tracer-carriage 1 in lines parallel with the longer axis of the sole-former L the cutter-bar m^4 is given a movement in the corresponding direction, which as to any and all portions or the whole of its length, and whether its whole length be equal or greater or lesser than the longer axis of the sole-former L is at any and all times in an exact and direct proportion to the aforesaid movement of the tracer-carriage 1. In

this operation of carriages 1, 2, and 3 the radius-bar N slides upon and through the clasp d^2, pivoted to carriage 2, and thus lengthens or shortens, as it were, as the distance of the pivot c^2 of the radius-bar N to carriage 1 from the pivot e^2 of clasp d^2 is greater or lesser in length under the travel of the pivot j^2, which connects carriage 3 to said radius-bar in lines parallel with the length of the sole-former.

The operation above described of the tracer-carriage 1 through radius-bar N on carriage 3 obviously affects the length of travel in one direction of the cutter-bar m^4—that is, in the direction of the longer axis of the sole-former L—and it thereby enables a cut to be obtained from the cutter-bar m^4 in such direction along a line having either an equal or a greater or a lesser length in relation to the length of the sole-former. In order that this effect upon the travel of the cutter-bar m^4 in relation to the longer axis of the sole-former may be represented with absolute accuracy and certainty, so as to obtain from one and the same sole-former L a regular and systematic grading of the operation of the cutter-bar m^4 in relation to the length of the sole-former in accordance with the usual custom of grading boot and shoe soles as to their length, the hand-wheel T, through which the adjustments for such purpose are made, as aforesaid, is provided with the series of notches and graduations t^2, before described. In this regard, as before stated, the figuring of these notches on hand-wheel T stands for the varying sizes in length of boot and shoe soles, and such notch between each two of the notches to which the figures pertain stands for the half-sizes, between the sizes represented by the numbers which pertain to the preceding and following notches, as has been described. In connection with this adjustment through hand-wheel T of the pivotal connection j^2 of carriage 3 to radius-bar N, which connects tracer-carriage 1 and carriage 2, a similar further change or adjustment thereof is secured by loosening the set-screws n^2, which fasten the rack-bar l^2 to the triangular frame O of carriage 3, and turning the screw-bolt q^2 in the proper direction therefor, and then tightening up the said set-screws, as has been described, and then proceeding as before through the hand-wheel T. This adjustment is, as is obvious, independent of the adjustment through the hand-wheel T, and again by it, plainly, when made, the pivotal connection j^2 of carriage 3 to radius-bar N can be given such a position, relative to the pivotal connections c^2 e^2 of tracer-carriage 1 on said radius-bar, and of said radius-bar N to carriage 2, and to the then after adjustments of the same pivotal connection j^2, in accordance with the notches and graduations of the hand-wheel T, as to secure, without a change of the sole-former, the same effect as if another former was inserted of an increased or decreased length, as the case may be, and that this effect will be in accordance with the increase or decrease in the distance of travel given by such adjustment to the pivotal connection j^2 of carriage 3 to radius-bar N in relation to the length of the sole-former L under the travel of the tracer about the same.

As to the travel of carriage 2, and with it the travel of carriages 3 and 4, at right angles in relation to the longer axis of the sole-former L, as has been herein described, if the pivotal connections c^3 h^3 of radius-bar Y to the plate-slide W of carriage 3 and to carriage 4 be coincident with each other, then carriage 4 or cutter-bar carriage remains stationary upon and has no movement across carriage 3 for and during any and all portions of the travel of such carriage 3 with carriage 2 in a direction across the longer axis of the sole-former L, and as a consequence the cutter-bar m^4 will thus be carried in a direction corresponding and exactly equal to the width of the sole-former. Now, if this coincident relation of the pivotal connections c^3 h^3 of carriages 3 and 4 be changed by adjusting and setting either through the hand-wheel T, or through the lever-handle V, or through both acting upon the slide-plate W of carriage 3, as described, the pivotal connection c^3 of such plate W, and thus of carriage 3 to radius-bar Y, in relation to the pivotal connection h^3 of carriage 4, to said radius-bar, so that the distance between the latter pivotal connection c^3 and the pivotal connection z^6 of same radius-bar to the frame A^2, (which frame is stationary as to the transverse movement of carriage 2 on frame A, but moves in conjunction with carriage 3 on carriage 2,) shall be greater or lesser than that of the pivotal connection h^3 of carriage 4 to radius-bar Y, then, under the travel of carriage 3 with carriage 2 in the direction of the width of the sole-former, the movement of carriage 4 in a corresponding direction, if such distance be greater, will be increased, and if such distance be lesser, decreased, in length as to the whole length of the travel of the carriage 2 at right angles to the length of the sole-former, and as a consequence the cutter-bar in its movement in a similar direction will be correspondingly affected, and thus be made to pass over a greater or lesser distance, as the case may be, than the whole width of the sole-former. In this operation of carriages 3 and 4 relative to each other the radius-bar Y slides upon and through the clasp d^3, pivoted to carriage 4, and thus lengthens or shortens, as it were, as the distance of the pivot c^3 of radius-bar Y to carriage 3 from the swivel-stud f^3 or clasp f^3 on frame A^2 is greater or lesser in length under the travel of the pivot h^3, which connects carriage 4 to said radius-bar upon carriage 3.

The operation of carriage 4 or cutter-bar carriage in relation to itself and to the transverse travel of carriages 2 and 3 on frame A, as above described, and which, primarily, arises from the travel of the tracer around the sole-former, as described, obviously affects the length of travel in one direction of the cutter-

bar—that is, in the direction of the width or shorter axis of the sole-former—and thereby enables a cut to be obtained from the cutter-bar m^4 in such relation along a line having either an equal or a greater or a lesser length in relation to the width of the sole-former. In order that this effect upon the travel of the cutter-bar in relation to the shorter axis or the width of the sole-former may be represented with absolute accuracy and certainty, so as to obtain from one and the same sole-former a regular and systematic grading of the operation of the cutter-bar in relation to the width of the sole-former, in accordance with the usual custom of grading boot and shoe soles as to their width, the hand-wheel is provided with the series of notches and graduations i^2, before described, and the handle-lever V, as before stated, applies to such notches and graduations. Through this handle-lever V the adjustments as to width of movement to the cutter-bar can be obtained independently of the adjustments as to length of movement to the cutter-bar, while with the handle-lever interlocked with the hand-wheel the adjustments as to width of movement to the cutter-bar are made in proper relation to the adjustments as to length of movement to the cutter bar when the adjustments as to the length in such movements are made through the hand-wheel.

The independent adjustment as to the width of the movement of the cutter-bar above described, enables any desired width of movement to the cutter-bar to be obtained in relation to any adjustment as to the length of movement of the cutter-bar through the manipulation of the hand-wheel.

In regard to the notches and graduations of the hand-wheel for the width, as before stated, they stand for the varying sizes in width of boot and shoe soles, and each notch between each two of the notches, against which the figures are placed, stands for the half-sizes between the sizes represented by the figures which are against the notches at each side thereof.

In the mechanical connection herein shown and described between radius-bar Y and carriages 3 and 4 and frame A^2 the perpendicular distance relative to carriage 4 between the pivotal connections h^3 i^6 of radius-bar Y to carriage 4 and to frame A^2 is the greatest when the line through said pivotal connections is at right angles to the transverse line of travel of carriages 2, 3, and 4 across frame A, and the least when the pivotal connection h^3 of radius-bar Y to carriage 4 is at either end of the full length of the transverse movement of said carriages.

In the operation herein described of grading, as to the length, the perpendicular distance between the pivotal connections j^2 e^2, which, in that movement, correspond to the pivotal connections h^3 z^6 in the grading operations as to the width, is the same and equal at all parts and for the whole length of such movement; and, as before stated, in view of that fact, an exact and direct proportionate reduction or increase in length was given to the movement of the cutter-bar in that direction in relation to the length of the former.

To obtain as to the width a result similar to that described for the length, the connection shown and described is changed in this respect, that the pivotal point z^6 of connection of the radius-bar Y at the frame A^2 is so made that it will always be at the same distance perpendicularly from the transverse line of travel of pivotal connection h^3 of radius-bar Y to carriage 4, and the radius-bar Y will have a movement lengthwise over it. This arrangement of connection is particularly shown in Figs. 30, 31, 32, 33 of the drawings, Plate 6, and such arrangement forms a part of this invention, and it is to be used in lieu of the connection previously shown and described, and while such is the case it is not intended to herein or hereby waive any rights and privileges in the protection of the other arrangement of connection by a separate and distinct application for Letters Patent of the United States. Furthermore, these several figures represent an arrangement of mechanism by which to secure similar adjustments to those described and obtained through the hand-wheel T and handle-lever V, and as to such mechanism, while it forms no part of this invention in itself, yet it is not intended to herein or hereby waive any rights or privileges for its protection by a distinct and separate application for Letters Patent of the United States.

In the connection between radius-bar Y and frame A^2, (illustrated in Plate 6, Figs. 30, 31, 32, 33,) the plate-slide W of carriage 3 is provided on its upper side with a longitudinal dovetail block, Z^2, and with a dovetail bar, A^3, adapted to slide over and along the length of the block Z^2, and by a set-screw, p^5, to be set against further movement thereon, when so desired.

The bar A^3 crosses the plate-slide W at right angles to its length, and its edges along their length are dovetailed, and they carry a correspondingly dovetail slide-block, B^3, concentrically swiveled by a vertical pivot, q^5, to the eye-stud l^3 of the horizontal rod m^3 to the frame A^2, before referred to, and to which, as before described, the radius bar Y was connected. This swivel-pin q^5, between its slide-block B^3 and its eye-stud l^3, passes loosely and concentrically through a straight-sided washer, r^5, which fits loosely within the slot s^5, running lengthwise of the radius-bar Y. This constitutes the connection, and obviously the slide of the bar A^3 upon the block Z^2 in the direction of the length of the slide-plate W carries with it the swivel or pivotal connection q^5 of it to radius-bar Y along the rod m^3 of frame A^2, and thus the perpendicular distance between such pivotal connection q^5 and the pivotal connection h^3 of the same radius-bar Y to carriage 4 relative to the line of the travel of such carriage 4, together with carriages 3 and 2

across the line of travel of carriage 1 upon carriage 2, can be made greater or lesser, and when so made secured against movement by tightening up the set-screw p^5. With the pivotal connections h^3 q^3 of radius-bar Y to carriage 4 and to frame A^2 thus adjusted and set, then in any and all movements of carriages 3 and 4 across the line of travel of carriage 1 the same relative perpendicular distances are always maintained between the said pivotal connections, thus causing in all movements of carriage 4 upon carriage 3 and of both these carriages together across the line of travel of carriage 1 and of the cutter-bar in conjunction therewith a movement of the cutter-bar, which, as to any and all portions or the whole of its length, and whether its whole length be equal to or greater or lesser than the shorter axis or width of the sole-former L, is in exact and direct proportion to the movement of carriage 2 in the direction of the width of the sole-former.

The mechanism shown in Figs. 30, 31, 32, 33, Plate 6, by which operations and adjustments similar to those described of the hand-wheel T and handle-lever V are obtained, is as follows:

C^3 is a horizontal screw-threaded shaft, arranged in a line with and above the plate-slide W at the left-hand end thereof. This screw-threaded shaft C^3 turns loosely in an upright, D^3, of the plate-slide W, and is confined against lengthwise movement in such upright by its shoulders t^5 at each side of the plate-slide. At one end it bears against a raised projection, E^3, of the plate-slide W, and at the other end it carries a bevel gear-wheel, F^3, with which meshes a similar bevel gear-wheel, G^3, of a horizontal stud, H^3, arranged to turn in bearings of the upright D^3, before referred to, and provided with a crank-handle, I^3, for convenience in turning it. This screw-threaded shaft C^3 between its two ends screws into a screw-threaded nut, J^3, which projects downward through a slot running lengthwise of the plate-slide W, and below it is entered by another horizontal screw-threaded shaft, K^3. This lower screw-threaded shaft, K^3, runs in a parallel line with the upper screw-threaded shaft, C^3, and at the right-hand end of the plate-slide W it turns in a stationary upright, L^3, of the carriage 3, wherein it is held against a lateral movement by shoulders u^5 of the shaft at each side of said upright, and outside of and beyond said upright, it carries a bevel gear-wheel, M^3, and with this gear-wheel M^3 meshes a similar bevel gear-wheel, N^3, of a horizontal shaft, O^3, which runs at right angles to the length of the lower screw-threaded shaft, K^3, and is arranged to turn in the fixed upright P^3 of the carriage 3. This shaft O^3 carries a small gear-wheel, Q^3, which meshes into a larger gear-wheel, R^3, having a crank-handle, S^3, for convenience in turning it, and this wheel R^3 in turn meshes into a small gear-wheel, T^3, of a screw-threaded shaft, U^3, which is supported in the fixed upright P^3, and by shoulders is confined against escape lengthwise therefrom, and is in a line with the movement of the triangular frame-piece O along the guideway Q of carriage 3. This screw-threaded shaft U^3 enters and screws into a screw-threaded socket of said frame-piece O.

A turn of the handle I^3 at the left-hand end of the plate-slide W to the right or left moves the slide-plate in the same direction, and thus the position of the pivotal connection c^3 of radius-bar Y to such plate-slide, or, in other words, to carriage 3, is changed relative to pivotal connection of such plate-slide h^3 to carriage 4, the same as is done with the handle-lever V, as before described.

A turn of the handle S^3 of gear-wheel R^3 to right or left through the train of gearing and mechanism connected to the triangular frame O on the one side and on the other side to the plate-slide W, as has been described, enables the pivotal connection j^2 of carriage 3 to radius-bar N and of pivotal connection h^3 of carriage 4 to radius-bar Y to be both changed and adjusted in position the same as herein described in the turning of the hand-wheel T.

To gage either or both of these adjustments, pointers a^6 b^6 and graduated scales d^6 f^6 are suitably applied, as shown, which pointers and graduated scales are in substance the same as the two series of graduations of the hand-wheel T, the pointer w^2, and the handle-lever V, hereinbefore particularly described.

This machine is handled and operated in substance as follows: The leather from which a boot or shoe sole is to be cut is placed upon the cutting-block K^2, and then the clamping-plate U^2 is brought firmly and rigidly down upon it through the treadle Q^2, and there secured by catching the treadle in the proper notch, z^4, of the standard T^2. The hand-wheel T is then turned until the number of the size as to the length of the sole to be cut is at the index-pointer w^2, when the hand-wheel is bolted against further movement, and the handle-lever V is swung to similarly bring it to the number of the size as to width of the sole to be cut, when it is secured against further movement. These preparations being completed, the U-bracket must then be brought toward the front of the frame A, and the cutter-bar m^4 must be in a position sufficiently in front of the position which the U-bracket has when closed and fastened, as described, for it to be able to come back to such position after having completed its circuit of the block K^2, moving in the general direction of the arrows, Fig. 15, without abutting against the U-bracket, which, during the meantime and after the cutter-bar m^4 has passed sufficiently around therefor, has been closed and fastened. In this position (see Fig. 15) of the cutter-bar m^4 the tracer M is at the starting-point in its path about the sole-former L, at which point is located the stud r', by and through which the tracer M operates to automatically unclutch the driving-pulley D

of the machine from the driving-power, all as has been before described. The gearing mechanism s^3 t^3 of the cutter-bar m^4 is now put into connection and made secure in such connection by its holding-bolt y^3. This places the cutting-edge t^4 of the cutter-bar m^4, as also the foot-piece n^4, through which the cutter-bar plays, against the leather, and the foot-piece n^4 enters by its edge u^4 into the thickness of the leather at the rear of the cutting-edge of the cutter-bar. Now, by a clutch of the driving-pulleys through the lever G, and a set thereby of the clutching-lever F against its holding-edge k under the pin r' in the pathway of the tracer M, the machine is put into operation. This operation consists, in substance, first, in a continuous travel of the tracer M about the edge of the sole-former L; second, in a continuous travel, because of such travel of the tracer, of the cutter-bar m^4 in a corresponding direction over the surface of the cutting-block K^2; but this travel in such direction of the cutter-bar m^4 is regulated or affected as to width and length in accordance with the principles of operation of the several carriages 1, 2, 3, and 4 and radius-bars N Y and their respective connections together, as has been herein described; and, third, in a continuous reciprocating movement of the cutting-edge against and through the leather, whereby the leather is cut in a continuous line with the direction of travel of the cutter-bar, as aforesaid, and as it so cuts the cutting-edge is constantly surrounded by the presser-foot n^4, which not only drags and presses upon the leather, but by its edge u^4 enters into and follows along the line or cut at the rear of the cutting-edge, and causes thereby the cutting-edge t^4 of the cutter-bar m^4 at any and all times to be presented in a line coincident with the line of direction of the cut which is to be made in the leather by it, because of its said travel from the movement of the tracer.

While these several movements are occurring, and as soon as the cutter-bar has traveled sufficiently therefor, the U-bracket is swung backward and locked to the frame, as described, and on the completion of the travel of the tracer about the sole-former, the tracer, by its stud q', forces down the pin r', and thus releases the clutching-lever F to its spring i, which, reacting, throws the said lever in the proper direction to unclutch the driving-pulleys, whereby the machine is automatically stopped in all its movements. This completes the cutting out of a boot or shoe sole, upon which the driving-gearing for the cutter-bar m^4 is put out of connection on the release of its holding-bolt, as has been described. The locking-catch for the U-bracket is released through the treadle X^2, and thus set free to be swung by the spring k^3 toward the front of the machine, and the treadle Q^2 is set free, which secures, through the spring y^4, the lift of the clamping-plate U^2 from the sole cut, and thus the sole can be removed, which being done the cutting of another sole is then proceeded with as before, and so on.

The foot-piece n^4, although herein described as constructed and arranged to press or drag upon the leather as it is cut, and also to enter the line of cut, may be constructed and arranged for either one of its said operations only, and still secure the presentation of the cutting-edge to the material in a line at all times coincident with the line of cut by the cutter-bar; but it is as well, and better, to combine and use them both as described.

As herein described and shown, the machine is arranged for its automatic stoppage with the tracer at the heel of the former L; but, obviously, it may be arranged for similar automatic stoppage at other points in the line of the travel of the tracer about the sole-former, according as may be found desirable in the use of the machine for cutting out parts of a sole—as, for instance, half-soles.

The belt J^2, which, as herein described, is provided with a series of eyeleted holes, is made by first punching holes in the belt, and then securing eyelets therein, and if these holes are to be any considerable distance apart it would preferably be best to take the stretch out of the belt before punching it, to the better insure the retention of the eyeleted holes at their equal distances apart in the running of the belt.

In this machine, to substitute one sole-former for another, it is necessary to draw the tracer back from contact with the edge of the sole-former, or to otherwise remove it from such contact. For so drawing it back, (see Fig. 1,) a hole, v^5, is made in the outer portion of slide-plate i' to tracer for the reception of a pin-block, w^5, of a lever, V^3, Figs. 1 and 4, hung upon the frame A. Placing this pin-block w^5 in said hole v^5 and then pushing the lever backward secures the pulling away of the tracer slide-plate i' from contact with the edge of the sole-former. When fastening said lever in such position the tracer-slide i' may be so held as long as desired. This position of the tracer-slide leaves the sole-former free to be detached and removed and another one inserted, as may be desired, after which, releasing the said lever, the tracer slide-plate resumes its position against the edge of the sole-former through the action of the spring k', hereinbefore referred to.

For the adjustment of the pivotal connections of the radius-bar N to carriage 2, and of radius-bar Y to frame A^2, the adjoining parts, which for such purpose are moved the one upon the other, may be graduated or scaled in any suitable manner.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. A tracer arranged to travel and to follow about the edge or the periphery of a sole or other former, and constructed in itself and arranged in relation to its operating mechanism

to secure an automatic arrest of its movement, substantially as and for the purpose described.

2. The combination of a sole or other suitable former, L, and of a tracer, M, arranged to travel and follow about the former L, with studs or pins q' r', arranged in relation to each other and to an operating mechanism for the tracer, all substantially as and for the purpose described.

3. A tracer, M, made in parts adapted to slide upon each other and to be pressed in opposite directions and constructed for a lever, V^3, to be interlocked with one of its parts, substantially as and for the purpose described.

4. A swiveling cutter-bar, m^4, of polygonal shape in cross-section, adapted for a reciprocating movement in relation to a block or platform, K^2, in combination with a foot-piece, n^4, which is constructed and arranged for said cutter-bar in its said movement to pass through it, and also to press or drag upon the material being cut by the cutter-bar at and about the line of such cut, all substantially as and for the purpose described.

5. A swiveling cutter-bar, m^4, of polygonal shape in cross-section, adapted for a reciprocating movement in relation to a block or platform, K^2, in combination with a foot-piece, n^4, which is constructed and arranged for said cutter-bar to pass through it and for it to enter and remain in the line of cut from the cutter-bar in the material which is being cut at a point behind the cutting action of the cutter-bar, all substantially as and for the purpose described.

6. A swiveling cutter-bar, m^4, of polygonal shape in cross-section, and adapted for a reciprocating movement in relation to a block or platform, K^2, in combination with a foot-piece, n^4, which is constructed and arranged for said cutter-bar in its said movement to pass through it, and to both press or drag upon the material being cut by the cutter-bar at and about and to enter and to remain in the line of such cut, all substantially as and for the purpose described.

7. A cutter-bar, m^4, constructed and arranged, substantially as herein described, to swivel, to reciprocate, and to be connected to and disconnected from its operative mechanism at pleasure, in combination with a cutting platform or block, K^2, all substantially as described.

8. The gear-wheels s^6 t^6, their respective supports, carriage 4, and upright w^3, arranged the latter to be moved up and down to engage and disengage the said gear-wheels, the concentric tubular extension x^3 w^3 of said supports, in combination with a cutter-bar, m^4, eccentrically connected to gear-wheel s^6, and moving through the tubular extension w^3, and with a spring, z^3, connected to each of said supports, all substantially as and for the purpose described.

9. A swiveling cutter-bar, m^4, adapted for a reciprocating movement upon a suitable carrier therefor, which in turn is arranged to move across such line of movement of the cutter-bar and in two directions at right angles to each other, in combination with mechanism in substance composed of two universal joints, E^2 G^2, and a telescoped and longitudinally-splined connecting-rod, F^2, and arranged to connect the operating mechanism for the said cutter-bar m^4 with any suitable driving mechanism, all substantially as and for the purpose described.

10. The foot-piece n^4, either with or without an edge, u^4, and a collar, r^4, in combination with a swiveling cutter-bar, m^4, and its guiding-tube W^3, having shoulders q^4 s^4, and a spiral spring, p^4, all substantially as and for the purposes and operations described.

11. A block or platform, K^2, supported on a suitable support, in combination with a carrier for a clamping-plate arranged to be swung upon said plate and to be fastened against such movement, either to said plate or to a suitable stationary abutment, such as a rail, W^2, or to both, all substantially as and for the purpose described.

12. A block or platform, K^2, supported upon a suitable support, and a carrier for a clamping plate arranged to be swung upon said plate and to be fastened against such movement, either to said plate or to a stationary abutment, such as a rail, W^2, or to both, in combination with mechanism for releasing said fastening of the plate, all substantially as and for the purpose described.

13. A block or platform, K^2, supported upon a suitable support, and a carrier for a clamping-plate arranged to be swung upon said plate and to be fastened against such movement, either to said plate or to a suitable stationary abutment, such as a rail, W^2, or to both, in combination with mechanism for releasing said fastening of the plate and for swinging the said clamp-carrier upon the said clamp, all substantially as and for the purpose described.

14. A block or platform, K^2, supported upon a suitable support, and a carrier for a clamping-plate arranged to be swung upon said plate and to be fastened against such movement, either to said plate or to a suitable stationary support, such as a rail, W^2, or to both, in combination with a treadle-lever, Q^2, which is connected to a releasing-lever, Y^2, for the said fastening, and also to the clamp-carrier in a manner to secure through the movement of the treadle in one direction both a release of said fastening and a swing of the clamp-carrier, all substantially as and for the purpose described.

15. A block or platform, K^2, supported upon a suitable support, and a carrier for a clamping-plate, U^2, arranged to be swung upon said plate and to be fastened against such movement by bolt g^5 interlocking with said plate, and a lever, V^2, interlocking with a stationary abutment, such as a rail, W^2, and connected together so as to be simultaneously disengaged through the lever V^2, all substantially as and for the purpose described.

16. A block or platform, K^2, supported upon a stationary post, x^4, in combination with

a U-bracket which projects over both sides of said platform, and is arranged to swing upon and to be moved along the length of said post, each independently of the other, and at one side of the platform has a clamping-plate, U^2, swiveled to it, all substantially as described, for the purpose specified.

17. The combination, with a block or platform, K^2, supported by a post, of a U-bracket which projects over both sides of said platform, and is arranged to be swung upon and to be moved along the length of said post, and at one side of said platform has a clamping-plate, U^2, swiveled to it, with a treadle-lever, Q^2, connected to said U-bracket, and arranged to move it and its clamping-plate in one direction relative to said platform and to fasten it and its plate in such position, and to allow it, when unfastened, to move in the other direction under the action of a spring, y^4, or otherwise, all substantially as described, for the purpose specified.

18. First, a sole or other suitable former; second, a tracer adapted to travel around the same; third, a carriage pivoted to said tracer, and adapted to travel upon another supporting-carriage in parallel lines to one direction of the sole-former, and to travel conjointly with such supporting-carriage in parallel lines across said direction of travel relative to the sole-former; and, fourth, a carriage arranged upon said supporting-carriage to travel in one direction of its said two directions of travel upon it and in the other direction in conjunction with it, in combination with mechanism which connects said supporting-carriage to both of the other carriages aforesaid, and is constructed and arranged to maintain at any and all points in the travel of all of said carriages the same relative perpendicular distances between the said pivotal points of such connecting mechanism, all substantially as and for the purpose described.

19. A sole or other former, L, and a tracer, M, adapted to travel around the same, in combination with carriages 1 2 3 and a radius-bar, N, directly pivoted to carriages 1 and 3, and adapted to play lengthwise through a clasp, d^2, pivoted to carriage 2, when severally arranged and combined together to operate as a whole, substantially as and for the purpose described.

20. A carriage arranged to travel upon another carriage and together with such supporting-carriage to move as one across the line of such travel, and constructed in parts arranged the one to be moved and adjusted and set upon the other in a direction across its said line of travel upon said supporting-carriage, and in such moving part pivoted at f^2 to a slide, i^2, of a radius-bar, N, which moves lengthwise through a clasp, d^2, pivoted to said supporting-carriage, and is connected by a pivot, c^2, to a carriage, 1, in turn hung by a pivot, s', to a tracer, M, arranged to move about a sole or other suitable former, all substantially as described, for the purpose specified.

21. First, a sole or other suitable former; second, a tracer adapted to travel around the same; third, a carriage pivoted to said tracer, and adapted to travel upon another and supporting-carriage in parallel lines to one direction of the sole-former, and to travel with such supporting-carriage in parallel lines across said direction of travel relative to the sole-former; and, fourth, a carriage arranged upon said supporting-carriage to travel upon it in one direction of its said two directions of travel, and in conjunction with it in the other direction, and provided with a carriage that is arranged to travel upon it across its direction of travel upon its supporting-carriage, in combination with mechanism which connects said latter carriage to the carriage that moves, as aforesaid, upon the supporting-carriage, and to a support thereof, moving therewith only in its travel upon and not in its travel with its supporting-carriage, and which is constructed and arranged to maintain at any and all points in the travel of said latter carriage across the carriage which carries it the same relative perpendicular distance between the several pivotal points of such connecting mechanism, all substantially as described, for the purpose specified.

22. A carriage, 3, constructed in parts adapted to slide and to be adjusted and set, the one upon the other, and in its said moving part pivoted to a radius-bar, Y, which is in turn pivoted to a carriage, 4, arranged to move upon said carriage 3 across the slide of its said part, and which is arranged to travel lengthwise through a clasp swiveled to a frame, A^2, that is stationary as to the movement of carriage 4 upon carriage 3, in combination with a carriage, 2, upon and along which carriage 3 with carriage 4 moves at right angles to the line of movement of carriage 4 upon carriage 3, all substantially as described, for the purpose specified.

23. A carriage, 3, constructed in parts adapted the one to slide and be adjusted and set upon the other, and connected through the radius-bar N to carriages 1 and 2, which are arranged for the former to move upon the latter, and carriage 3 upon the latter, in combination with mechanism constructed in itself and arranged in relation to the said sliding part of carriage 3 to secure through its operation a movement of said part, and thus the adjustment of its connection along the length of said radius-bar, all substantially as described, for the purpose specified.

24. A carriage, 3, constructed in parts adapted to slide and to be adjusted and set, the one upon the other, and in its said moving part connected through the radius-bar Y to carriage 4, which travels upon said carriage 3, and provided with mechanism constructed in itself and arranged in relation to said moving part of said carriage 3 to secure a movement of said part, and thus adjustment of its connection along the length of said bar, all substantially as and for the purpose specified.

25. A carriage, 3, made in parts, constructed and arranged the one to move upon and be fastened to the other, in combination with a shouldered screw-bolt, q^2, arranged in relation to said parts, all substantially as and for the purpose described.

26. A sole or other suitable former, a tracer adapted to travel around the same, carriages 1, 2, and 3, arranged in relation to each other and to said tracer, and connected to a radius-bar, N, in combination with a carriage, 4, arranged to travel upon carriage 3, and pivoted to a radius-bar, Y, which is in turn pivoted to carriage 3, and is adapted to play lengthwise through a clasp pivoted to a support, A^2, stationary as to the movement of carriage 4 upon carriage 3, and of carriages 2 and 3 in same direction, but moving with carriage 3 upon carriage 2, when severally combined and arranged together, all substantially as herein described, and for the purpose specified.

27. The hand-wheel T, connected with the moving part O of carriage 3, and notched about its periphery, as at t^2, in combination with a stop-pin, u^2, arranged to engage with said notches, all substantially as and for the purposes described.

28. The notches z^2 of hand-wheel T, in combination with a handle-lever, V, arranged to engage with said notches, and otherwise connected with the moving part W of carriage 3, to which carriage 4 is connected, all substantially as and for the purpose described.

29. The hand-wheel T, provided with two series of notches, t^2 z^2, in combination with a stop-pin, y^2, and handle-lever y, both arranged in relation thereto, and the wheel and handle-lever V, connected through gearing or its equivalent to the parts O and W of carriage 3, adapted to slide thereon, all substantially as and for the purpose described.

30. The wheels u', having flanges x', provided with inside beveling faces, y', and arranged to run by such beveling faces against and along beveling faces of a rail, v', in combination with a shouldered axial pin, z', all substantially as described, for the purpose specified.

31. A machine for grading patterns, composed of a frame, A, a stationary former, L, a tracer, M, carriages 1, 2, 3, and 4, frame A^2, radius-bars N and Y, a reciprocating cutter, m^4, and its foot-piece n^4, and platform K^2, with its clamp U^2 and its carrier P^2, severally constructed and combined and arranged together to act in conjunction with and in relation to each other upon the application of power thereto, all substantially as and for the purpose specified.

32. The dovetail grooved block a^5 of clamp-plate U^2, having pin d^5, and the dovetail block b^5, having notch c^5, and swiveled to U-bracket P^2, in combination with notched block f^5 of clamp-plate U^2 and locking-bolt g^5, all substantially as and for the purpose described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

JAMES J. BREACH.

Witnesses:
ALBERT W. BROWN,
WM. S. BELLOWS.