A. BATES.

MACHINE HAVING A VIBRATING TOOL EMPLOYED IN THE MANUFACTURE OF BOOTS AND SHOES.

APPLICATION FILED APR. 4, 1906.

979,249.

Patented Dec. 20, 1910.

2 SHEETS—SHEET 1.

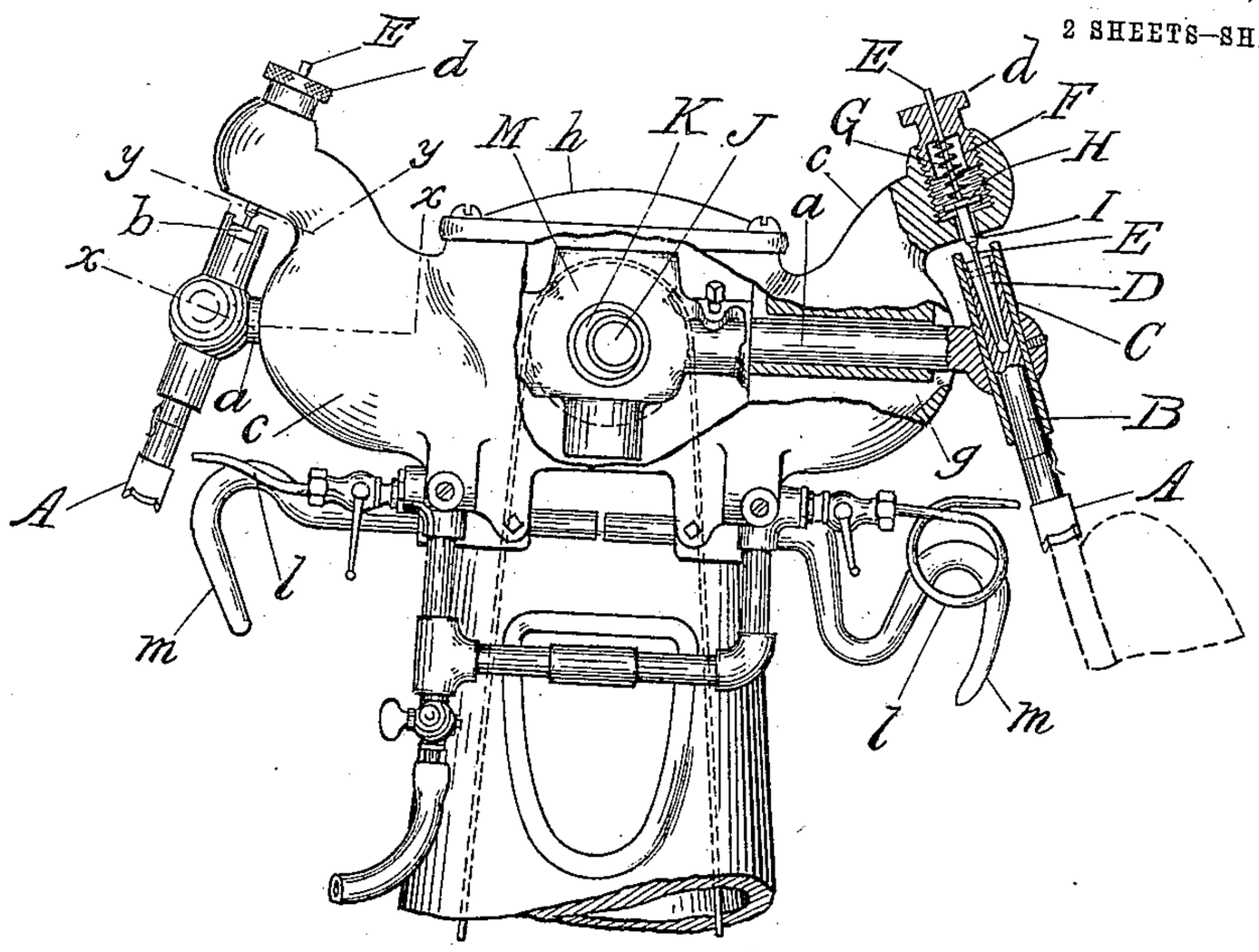

Fig. 1.

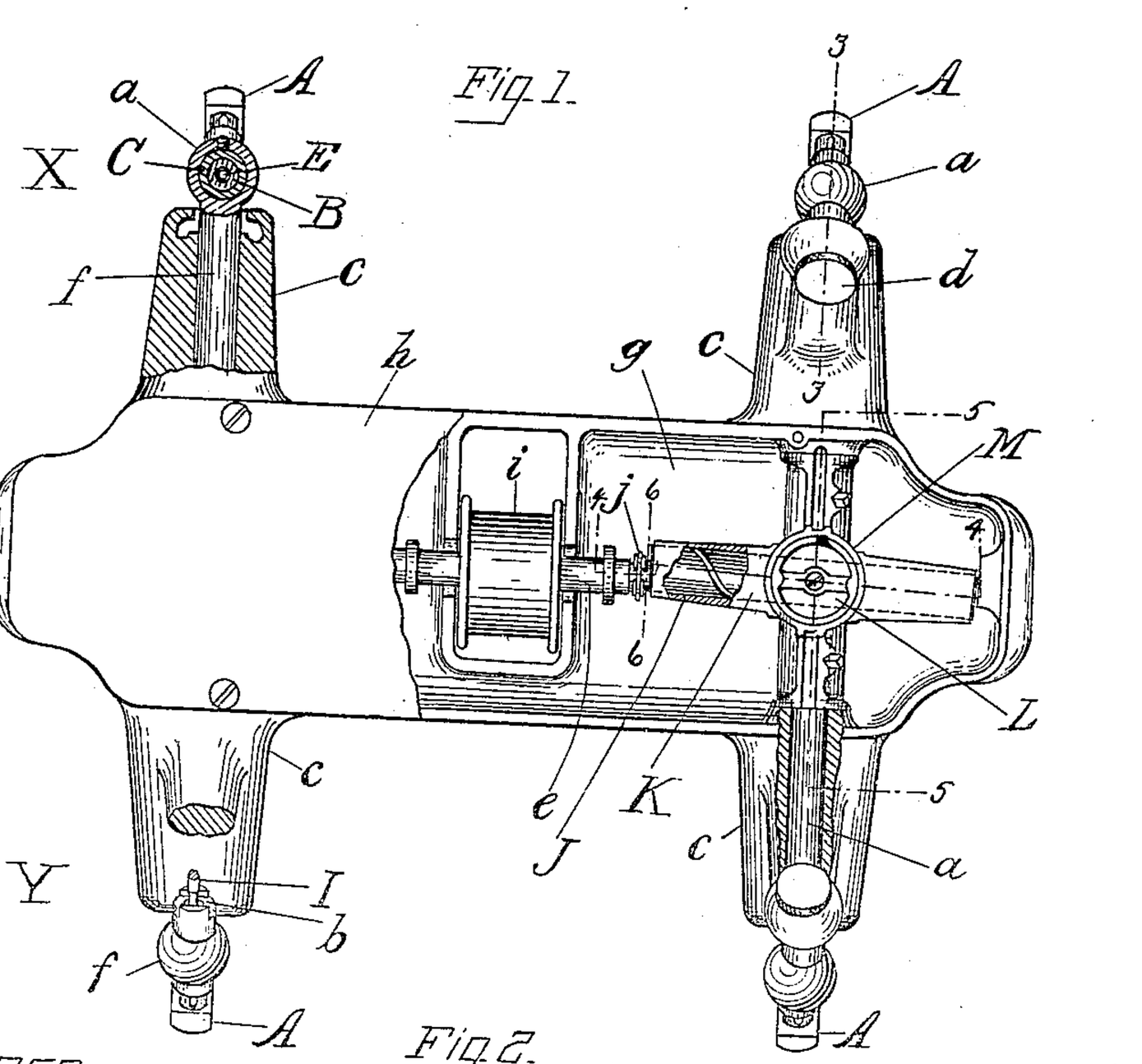

Fig. 2.

WITNESSES.

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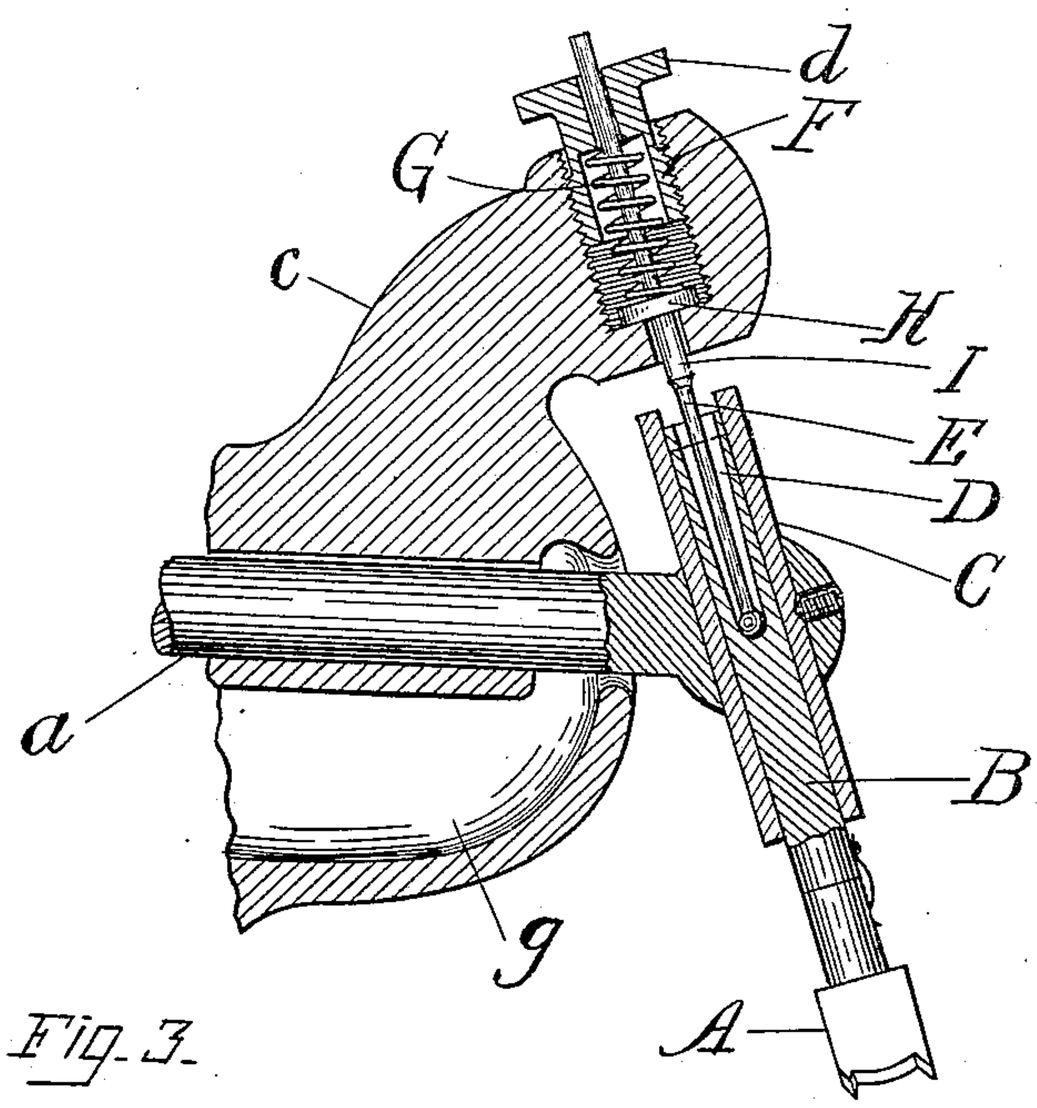

Fig. 3.

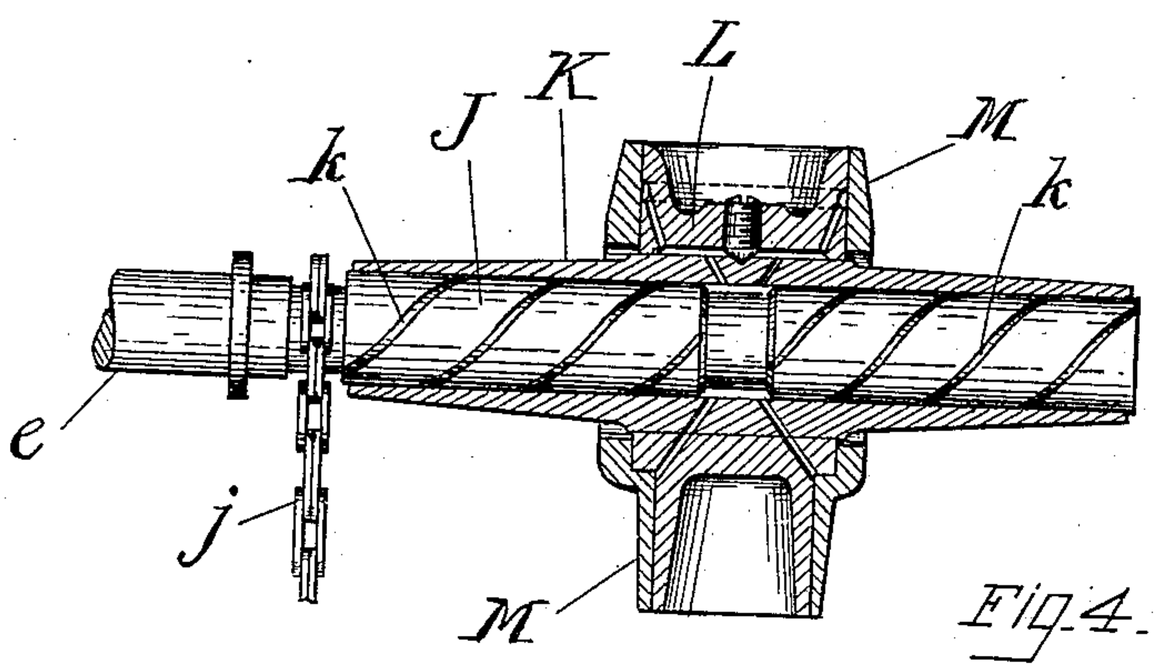

Fig. 4.

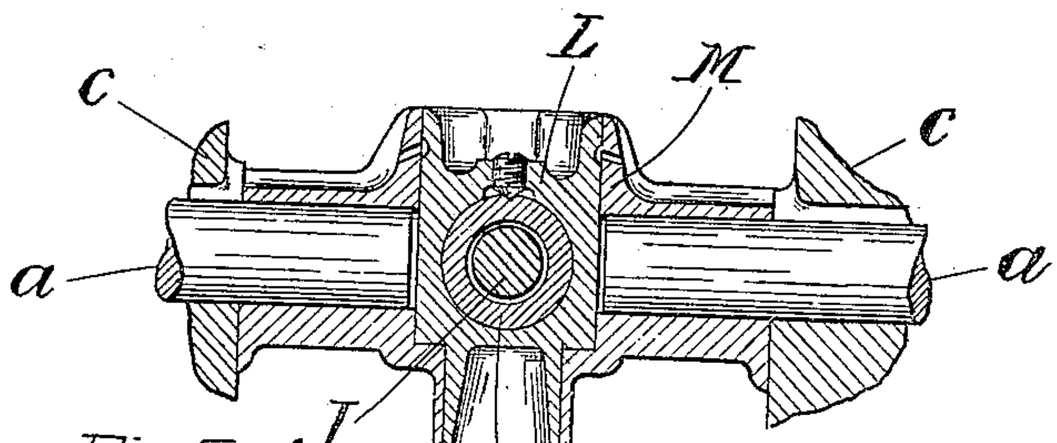

Fig. 5.

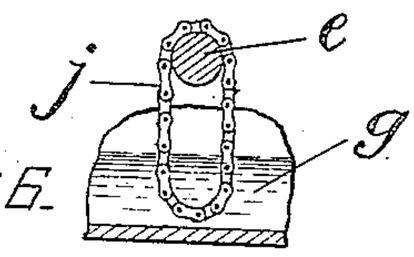

Fig. 6.

WITNESSES.

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UNITED STATES PATENT OFFICE.

ARTHUR BATES, OF LEICESTER, ENGLAND, ASSIGNOR TO UNITED SHOE MACHINERY COMPANY, OF PATERSON, NEW JERSEY, A CORPORATION OF NEW JERSEY.

MACHINE HAVING A VIBRATING TOOL EMPLOYED IN THE MANUFACTURE OF BOOTS AND SHOES.

979,249. Specification of Letters Patent. **Patented Dec. 20, 1910.**

Application filed April 4, 1906. Serial No. 309,764.

To all whom it may concern:

Be it known that I, ARTHUR BATES, a subject of the King of England, residing at Leicester, in the county of Leicester, England, have invented certain Improvements in Machines having Vibrating Tools Employed in the Manufacture of Boots and Shoes, of which the following description, in connection with the accompanying drawings, is a specification, like reference characters on the drawings indicating like parts in the several figures.

This invention relates to machines having vibrating tools employed in the manufacture of boots and shoes; as, for example, in burnishing, polishing, rubbing, shaping, bending, pounding or otherwise treating parts of boots and shoes.

More particularly the invention relates to improvements in the mounting of vibrating tools whereby said tools are permitted to yield during their operation without involving improper stresses and vibration commonly experienced heretofore in the use of yielding vibrating tools.

The expression "vibrating tools" used herein is to be understood as including tools which oscillate along curvilinear paths, tools which reciprocate along rectilinear paths, and tools which vibrate along endless paths such as a circle or an ellipse. In the last named motion the tool may constantly retrace its path moving always forwardly, but such motion is nevertheless to be considered a species of vibration within the meaning of the term as used herein. Obviously the "tool" or "tools" herein mentioned need not necessarily act immediately upon a boot or shoe but may contribute only indirectly to the operation on said boot or shoe.

Prior to this invention, a machine having a yielding vibrating tool for use in the manufacture of boots and shoes, was subject to rapid destructive wear which in time permitted considerable lost motion of engaging parts and caused the machine to operate noisily with serious disturbing effect upon the operator whose alert attention is of especial importance if a vibrating tool be intended to operate immediately upon a boot or shoe. This difficulty of rapid and destructive wear resulted, in the main, from two correlated causes. One such cause resided in the manner of operation of cushioning means, for permitting a tool to yield, which involved the application of abnormal stresses to moving elements of the mechanism. A further cause of wear resided in the violent vibration of moving parts of the mechanism set up in translating motion of actuating means into motion of a different character for driving a vibrating tool. The wear resulting from either one of these causes tended to increase improper vibration of the mechanism, which in turn increased wear so as to permit still further improper vibration, and thus the difficulties in machines heretofore used multiplied themselves.

This invention is designed particularly to avoid the first named cause of wear; and it also contemplates the combination of improved cushioning means and novel actuating mechanism which coöperate to eliminate all material wear and improper vibration.

In many cases, but not invariably, it is desirable to provide a vibrating tool with a yielding cushion, for the purpose of permitting the tool to yield in response to reactionary thrusts of the work; and the invention will be described herein with especial reference to this purpose. It is to be understood, however, that an embodiment of this invention may be employed conveniently for cushioning a vibrating tool for other purposes than that just mentioned.

In machines used prior to this invention it has been customary to mount a tool in a vibrating holder, the tool being movable therein against the tension of a cushioning spring carried by the holder. Thus the tool was permitted to yield, but the thrusts of the work, acting upon the tool, were transmitted through the cushioning spring to the vibrating holder, and thence to the bearings upon which the holder vibrated. In this manner the varying thrusts of the work were ultimately applied to bearing surfaces of the machine with the result that said bearing surfaces were soon worn so as to permit lost motion and improper vibration. Another arrangement for permitting a vibrating tool to yield comprised a spring abutting at one end against a stationary part of the machine

and at the other end against a lever or the like suitably associated with the tool, the spring being constantly under tension. Thus, while the thrusts of the work may have been expended ultimately against the frame of the machine, the reaction of the cushioning spring exerted a constant pressure tending to impede the vibration of the tool holder; and this pressure was transmitted to the bearing surfaces of the machine.

It is an object of this invention to relieve all parts of the mechanism, which contribute to vibrate the tool, from any material stresses or pressure due to thrusts against the tool.

To this end a feature of the invention consists in the combination of a tool, means for vibrating the tool, and provision independent of the vibrating means for permitting the tool to yield.

In some types of machines heretofore used the spring or the like for cushioning the tool exerted a constant pressure on the tool tending to impede its operation whether the tool was in active use or was running idly. Hence, even when there was no necessity for the tool to yield, the cushioning devices were nevertheless acting injuriously upon the mechanism.

It is a further object of this invention to provide cushioning means which are inactive as to any effect upon the mechanism except when the tool has occasion to yield.

To this end a feature of the invention consists in the combination of a tool, with cushioning means, for permitting the tool to yield, arranged to be inactive until the tool has begun to yield. Obviously the last named feature of the invention is not necessarily restricted to use in connection with a vibrating tool.

In the preferred embodiment of this invention the above described features cooperate with novel mechanism for driving a vibrating tool, which mechanism constitutes the subject-matter of a co-pending application Serial No. 304,484, filed March 6, 1906. Separately considered, the invention involved in said mechanism forms no part of the invention herein claimed; but combinations of said mechanism with the features above described, constitute important subject-matter of the present invention.

The mechanism for driving the tool, in its preferred form, is differentiated from any type of machine previously used, by the fact that in the operation of the latter some element was necessarily subjected to a considerable linear strain, of at least momentary duration, for the purpose of initiating or maintaining the motion of a driven element of the machine; while the operation of the present preferred mechanism is characterized by the translation of the motion of the actuating means into the desired motion of the tool by transmission means which co-act through friction alone without involving any material linear strain. Obviously the above described arrangement of cushioning means embodying features of this invention, coöperates with this preferred mechanism, in a highly effective manner, to avoid entirely the difficulties usually experienced in machines having yielding vibrating tools.

In this connection a further feature of the invention consists in the combination of a tool; actuating means; transmission means intermediate the actuating means and tool which co-act through friction alone to translate the motion of the actuating means into vibratory motion of the tool; and cushioning means, for permitting the tool to yield, arranged to be independent of the actuating means and transmission means.

Other features of the invention will be described herein and will be defined in the claims.

The preferred embodiment of this invention consists in a machine for setting and burnishing the sole edges of boots and shoes. Nothing herein contained is to be construed, however, as limiting this invention in the scope of its application to use in connection with edge setting machines.

A preferred form of edge setting machine embodying this invention is shown in the accompanying drawings in which;

Figure 1 is an end elevation, partly in section, of an edge setting machine; Fig. 2 is a plan view, partly in section, of the machine shown in Fig. 1; Fig. 3 is an enlarged sectional view on the line 3—3 of Fig. 2; Fig. 4 is an enlarged detail vertical section on the line 4—4 of Fig. 2; Fig. 5 is an enlarged detail vertical section on the line 5—5 of Fig. 2; Fig. 6 is a detail section on the line 6—6 of Fig. 2. In Fig. 2 the detail section at X is taken on the line *x*—*x* of Fig. 1; and the detail section at Y is taken on the line *y*—*y* of Fig. 1.

The machine shown in the accompanying drawings has provision for vibrating four tools A A A A (see Fig. 2). The holders and cushioning means for all four tools are preferably exactly alike and hence it will suffice to describe but one tool, its holder and cushioning means.

As shown in Fig. 3 a tool A is attached to the lower end of a plunger B. Obviously any desired form of tool may be employed and it may be secured to the plunger B in any practicable manner. The plunger B is axially movable in a tool holder C.

The tool holder C consists of a sleeve rigidly supported at the end of a tool-carrying shaft *a* by being secured in a spherical hub integral with said shaft. The shaft *a* is os-

cillated by rotating actuating means acting through transmission devices presently to be described. The downward movement of the plunger B, axially of the holder C, is limited by an appropriate stop *b* consisting of radial extensions of the plunger B which overlie the upper end of the holder C. The stop *b* is confined between bifurcations at the upper end of the holder so as to prevent rotation of the plunger relatively to the holder (see detail section Y, Fig. 2). Preferably the holder C is angularly disposed on the shaft *a* so that the vibration of the tool A takes place in a plane to which the operator's line of vision is substantially normal, thereby permitting the progress of the work to be readily observed. A sole edge of a shoe is shown in engagement with a tool on the right hand side of Fig. 1 (see dotted lines).

The plunger B contains a cylindrical recess D extending from its upper extremity to a point which lies, normally, substantially within the axis of oscillation of the holder C (see Fig. 3). With this arrangement the floor of said cylindrical recess D is normally subjected to very slight movement, if any, during the vibration of the tool. The lower end of a ball-ended strut E projects into the recess D, its ball-end lying adjacent to the floor of said recess (see Fig. 3 and detail section X, Fig. 2). The upper end of the strut projects through a socket F supplied in an overhanging arm of the head *c* of the machine. Within said socket F is a spiral spring G which bears downwardly toward the plunger B, its lower end abutting against a washer H loosely encircling the strut. The tension of said spring G may be adjusted by screwing in or out a nut *d* which is threaded into the top of the socket F (see Fig. 3). When the plunger B is in its normal position at its lowermost limit of movement in the holder C, the washer H is held stationary by resting upon the rigid floor of the socket F. Below the washer H the strut E is provided with an enlarged portion I which, when the strut is elevated, engages the washer, lifts it slightly and brings into play the tension of the spring G. Normally, however, the plunger rests at its lowermost limit of movement and the strut E is free from the influence of the spring G. When the plunger yields, even very slightly, (as for example in response to a thrust on the tool by the work) the strut is elevated to bring the spring G into play; and thereby the tool is provided with a yielding cushion whenever there is any occasion for the tool to yield. Thus the thrusts of the work upon the tool are not only ultimately expended upon the frame of the machine but the cushioning means for the tool is rendered entirely inactive as to any material effect upon the mechanism except when a thrust is applied to the tool, whereupon the cushioning means becomes immediately effective.

The preferred form of mechanism for vibrating the tool A, as shown in the drawings, comprises a driving shaft *e*, a pair of coaxial tool-carrying driven shafts *a a* and a second pair of coaxial tool-carrying driven shafts *f f*. The axes of said pairs of tool-carrying shafts are parallel and are perpendicular to the axis of the driving shaft. The frame of the machine consists of a standard supporting the head *c* which includes a chamber *g* inclosing the actuating mechanism of the machine. A removable cover *h* completes the closure of the chamber.

The pairs of tool-carrying shafts *a a* and *f f* are preferably exactly alike as regards both their associated parts and their connection with the driving shaft *e;* consequently it will suffice to describe in detail one pair of shafts *a a* in connection with the means for actuating them.

The shaft *e* is constantly rotated at a high speed and constitutes the principal driving element of the mechanism. This shaft may be supported conveniently by the tool-carrying shafts *a a* and *f f* as hereinafter described. The shafts *a a*, constituting driven elements of the mechanism, are journaled preferably in axial alinement in the head *c* of the machine. The transmission means for converting the rotary motion of the driving shaft *e* into oscillatory motion of the shafts *a a* comprises an exaxial member J, a sleeve K surrounding said exaxial member, a swivel block L rigid with said sleeve, and a hub M connecting the tool-carrying shafts *a a*. These parts are duplicated at the opposite end of shaft *e* for translating the motion of the latter into oscillatory motion of the shafts *f f*.

The first step in the translation of the rotary motion of the driving shaft *e* is effected by means of the exaxial member J. The expression "exaxial member" is employed herein to designate an element of the mechanism which has a normal axis noncoincident with the axis on which it rotates. In the preferred form shown in the accompanying drawings this exaxial member J consists of an integral portion of the shaft *e*, cylindrical in cross section, the normal axis of which is oblique to the axis of the shaft *e* and intersects the latter at its point of intersection with the common axis of the tool-carrying shafts *a a* (see Fig. 2). Being thus exaxially disposed on the shaft *e* said member J is caused to gyrate as the shaft rotates, the normal axis of said member generating a double cone. The gyration just described is communicated by the exaxial member J to the sleeve K. Preferably this sleeve encircles the exaxial member J throughout its entire length. The sleeve K

fits in an aperture in the swivel block L and is maintained rigid therein by means of a set-screw. In this manner the swivel block L is caused to gyrate in consonance with the exaxial member J. The swivel block L is supported within the hub M in such a manner that the former is rotatable relatively to said hub about an axis which is transverse to the normal axis of the exaxial member J. The swivel block is supported in said hub by shoulders of the hub (see Figs. 4 and 5). The hub M has laterally extending portions which embrace the adjacent ends of tool-carrying shafts *a a* and are rigidly secured thereto by means of set-screws (see Figs. 2 and 5). It will be noted that the translation of the rotary motion of the driving shaft *e* is effected, initially, through the co-action of two surfaces which have only frictional engagement with each other, *i. e.*, the surface of the exaxial member J and the inner surface of the sleeve K. The second step in this translation is also effected through the co-action of two surfaces having only frictional engagement with each other, *i. e.*, the outer surfaces of cylindrical extensions of the swivel block L (see Figs. 4 and 5) and the adjacent inner surfaces of the hub M.

The gyration of the exaxial member J gives to the swivel block L a characteristic motion which may be resolved into two components; the first component consisting in oscillation about the common axis of the cylindrical extensions of the swivel block, which serves merely to rock the swivel block back and forth in the hub and is not directly effective to translate rotary into oscillatory motion. The second component consists in oscillation about the axis of the tool-carrying shafts and is effective to oscillate said shafts through the agency of the hub. In promoting this second component of motion of the swivel block, the gyration of the exaxial member has the effect of a mechanical couple; *i. e.*, the exaxial member exerts substantially equal and parallel forces in opposite directions, which are applied to the sleeve, and therethrough to the swivel block L, on opposite sides of the axis about which said second component of motion takes place, that is to say, on opposite sides of the axis of the tool-carrying shafts. In like manner the second component of motion of the swivel block acts upon the hub with the effect of a mechanical couple serving finally to effect the oscillation of the tool-carrying shafts; *i. e.*, the swivel block exerts substantially equal and parallel forces in opposite directions, which are applied to the hub for oscillating the tool-carrying shafts on opposite sides of the common axis of said shafts. This arrangement of mechanical couples is desirable for the reason that it contributes to permit parts of the transmission means to be perfectly balanced and also utilizes to the best effect the energy of the actuating means. As shown in the drawings all of the axes of moving parts comprising a set of transmission means intersect in a common point and all of said parts are balanced about said point. Also in this preferred construction the driving shaft *e* has no support other than that afforded by the respective sleeves K K of different sets of transmission devices, disposed at opposite ends of the driving shaft, these sleeves being carried each in a swivel block which in turn is supported by a hub rigid with a pair of tool-carrying shafts.

It is not essential that all the axes of the moving parts of a set of transmission means intersect at a common point. It is sometimes desirable to have a tool move in an endless path such as a circle or an ellipse and to this end a common axis of the cylindrical extensions of a swivel block and the engaging portions of a hub might be displaced so as not to intersect in common with the other axes, the result being that an endwise reciprocation would be imparted to the tool-carrying shafts in addition to their oscillatory movement. In this manner the tool could be caused to move in an endless path. Other effects could be produced by displacing one or more of the other axes of the moving parts. If desired the tool could be arranged for reciprocation instead of oscillation as above described.

The transmission means, just described as communicating the motion of the driving shaft *e* to the tool-carrying shafts *a a*, are preferably duplicated at the opposite end of the shaft *e* for connecting the latter with the tool-carrying shafts *f f*. A belt pulley *i* (see Fig. 2), or other means for communicating power to the driving shaft, is secured to said shaft midway between the pairs of tool-carrying shafts. This symmetrical disposition of the tool-carrying shafts relatively to the belt pulley *i* is of importance since thereby the reaction of respective pieces of work operated upon simultaneously through tool-carrying shafts at opposite ends of the driving shaft balance in the vicinity of the belt pulley and substantially negative each other as to any material unbalanced effect upon the driving shaft or upon parts connected with it.

It would be practicable to associate more than two pairs of tool-carrying shafts with a single driving shaft and it would be equally practicable to associate but one tool-carrying shaft with a driving shaft. It is by no means essential that the axes of the tool-carrying shafts be mutually parallel or that they be perpendicular to the axis of the driving shaft.

The machine may be provided with gas jets 11 for heating the tools, and if desired with hand rests *m m* (see Fig. 1).

In connection with the above described preferred mechanism it is desirable to employ a lubricating system such as is described in the co-pending application hereinbefore mentioned. To this end the chamber *g* in the head of the machine is arranged to contain a supply of lubricant such as oil, and means is provided for delivering said lubricant to the various bearing surfaces of the mechanism. For example, an endless chain *j* (see Figs. 4 and 6) may encircle the driving shaft *e* with its lower portion submerged in the oil in the chamber *g*. The rotation of the driving shaft *e* drives said chain *j* rapidly through the oil, part of which is conveyed thereby to the driving shaft and is delivered at the end of the sleeve K. Here the oil enters one or more spiral grooves *k* which serve to pump it toward the opposite end of the sleeve. During the course of this movement the oil is forced through appropriate channels and conduits to all the bearing surfaces of the mechanism so as to keep them thoroughly and constantly lubricated. Upon completing its travel through various bearing surfaces the oil escapes and returns to the supply in the chamber *g*.

Various changes other than those already suggested might be made in the specific machine above described without departing from the proper field of this invention which is clearly defined in the subjoined claims and is not to be restricted to the subject-matter of the above detailed description.

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

1. A machine of the class described comprising, in combination, a rock-shaft, a tool arranged for yielding movement, means for supporting said tool from said shaft for to and fro movement thereby and cushioning means arranged to apply a yielding pressure to said supporting means at a point which is substantially stationary except for its yielding movement.

2. A machine of the class described comprising, in combination, a rock-shaft, a tool operated thereby, a device movable relative to said shaft on which the tool is detachably mounted, the axis of said shaft passing through the body of said device, and means arranged to apply a yielding pressure to said device at a point substantially in said axis.

3. A machine of the class described comprising, in combination, a yielding tool, a plunger supporting the tool, means operating through the plunger to vibrate the tool, said plunger having an abutment positioned at substantially the center of vibration of the tool, cushioning means for acting against said abutment and a stationary abutment for said cushioning means.

4. A machine of the class described comprising, in combination, a yielding tool, a plunger for the tool, means for vibrating said tool and plunger, a strut arranged to abut against said plunger at substantially its center of vibration, a washer arranged to engage said strut, cushioning means acting on said washer and an abutment coöperating with said washer to limit its movement.

5. In a machine of the class described, the combination of a yielding tool, a plunger for the tool having a longitudinal recess, a sleeve encircling said plunger, the latter being axially movable in the sleeve, a strut projecting into the plunger recess and arranged for abutting against the floor thereof, means for cushioning said strut and a stop for limiting the movement of the plunger in one direction.

6. A machine of the class described comprising the combination of a yielding tool, a plunger for the tool, means operating through the plunger to impart rapid to and fro movement to the tool, cushioning means for the plunger and transmitting means intermediate the cushioning means and plunger including a strut having a curved acting surface, said plunger being provided with a curved seat for said surface.

7. A machine of the class described comprising, in combination, a yielding tool, holding means for said tool, cushioning means operating upon said holding means at a point which is substantially stationary except for its yielding movement and provision whereby said cushioning means is inactive until the tool has begun to yield.

8. In a machine of the class described the combination of a yielding tool, means for holding said tool, cushioning means for said tool re-acting upon a part of the machine, separate from said holding means, two stationary abutments for said cushioning means and means for moving the cushioning means away from one of said abutments and in line with said tool to cause it to act on the tool.

9. In a machine of the class described the combination of a yielding tool, means for holding the tool, a strut arranged to act upon the holding means, a washer loosely encircling the strut, a spring acting on the washer and re-acting upon a part of the machine separate from said holding means, means for limiting the movement of the washer by said spring and means on the strut for engaging the washer and thereby bringing the spring into play when the tool yields.

10. A machine of the class described comprising, in combination, a tool, means for vibrating said tool, supporting means inter-

posed between the vibrating means and tool on which the tool is detachably mounted, said tool and supporting means being arranged for movement relative to the vibrating means, and cushioning means independent of said vibrating means arranged to apply a yielding pressure to the supporting means at a point which is substantially stationary except for its yielding movement.

11. A machine of the class described comprising, in combination, a rock-shaft, a tool, a plunger for said tool rocking with said shaft, a strut engaging said plunger at substantially its center of oscillation, a spring for cushioning the movement of said strut and two abutments between which said spring is confined, the strut being guided in both of said abutments.

12. A machine of the class described comprising, in combination, a machine frame, a rock-shaft mounted therein, a sleeve supported by said rock-shaft and extending transversely thereof, a plunger slidably mounted in said sleeve, a burnishing tool detachably mounted on said plunger, means for limiting the movement of said plunger relative to said sleeve, said plunger having a cavity formed longitudinally thereof, the bottom of said cavity lying substantially in the axis of said shaft, a strut extending into said cavity and having a ball end seated in the bottom of the cavity, a washer loosely encircling the strut, a shoulder on the strut arranged to engage said washer, a spring bearing against said washer at one end, and a nut through which said strut extends threaded into an aperture in the machine frame and bearing against the opposite end of said spring, the washer being arranged to rest upon the bottom of said aperture.

13. In a machine of the class described the combination of a yielding tool, actuating means, transmission means intermediate the actuating means and tool including an oscillating tool carrying shaft, and cushioning means for the tool arranged to act on the tool substantially within the axis of oscillation of said shaft.

14. In a machine of the class described the combination of a tool, actuating means, transmission means intermediate the actuating means and tool, said transmission means comprising a plurality of parts balanced about a single point and a rock-shaft having its axis passing through said point, and cushioning means independent of the actuating and transmission means arranged to act upon the tool in a direction transverse to the axis of said shaft, and at a point substantially within said axis.

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

ARTHUR BATES.

Witnesses:
GRACE HOLMES,
ARTHUR ERNEST JERRAM.