

A. R. HAVENER.
MACHINE FOR PUNCHING AND FEEDING SHEET MATERIAL.
APPLICATION FILED NOV. 1, 1910.

1,019,005.

Patented Feb. 27, 1912.

6 SHEETS—SHEET 1.

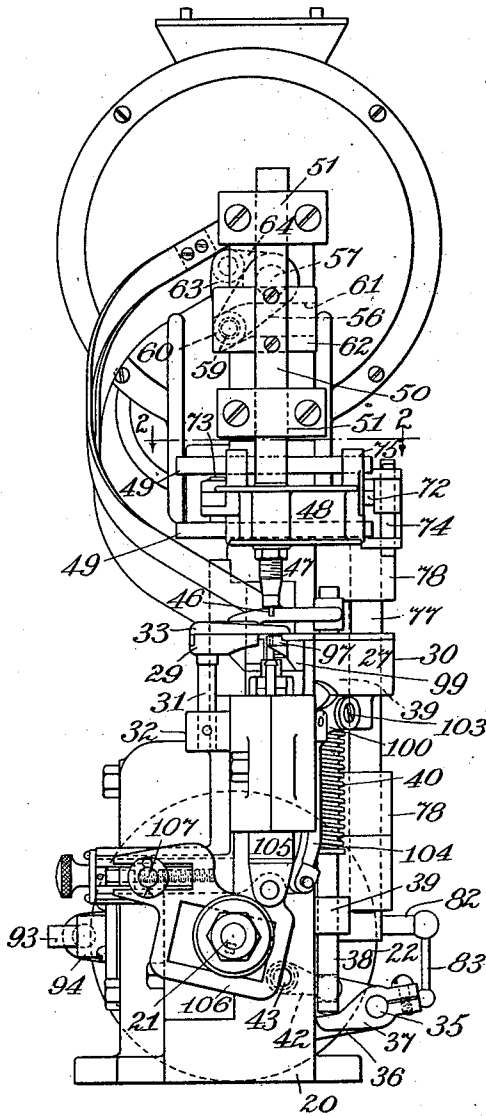


Fig. 1.

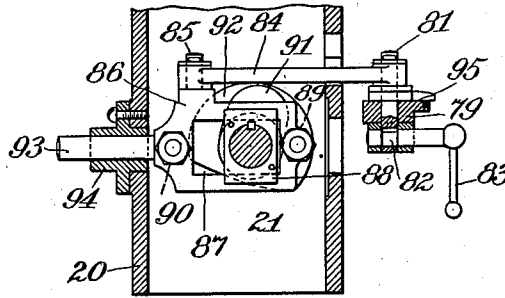


Fig. 3.

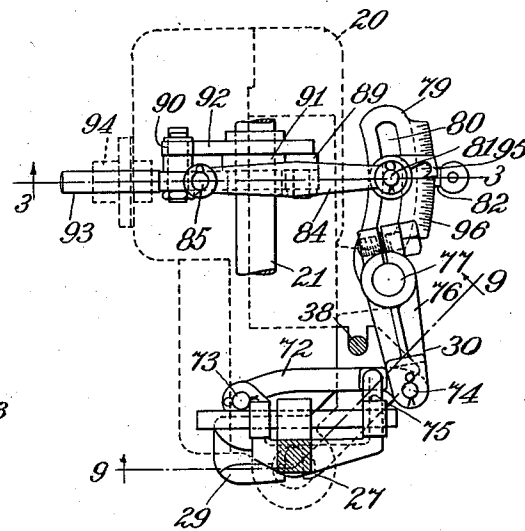


Fig. 2.

Witnesses:
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Leonard A. Powell

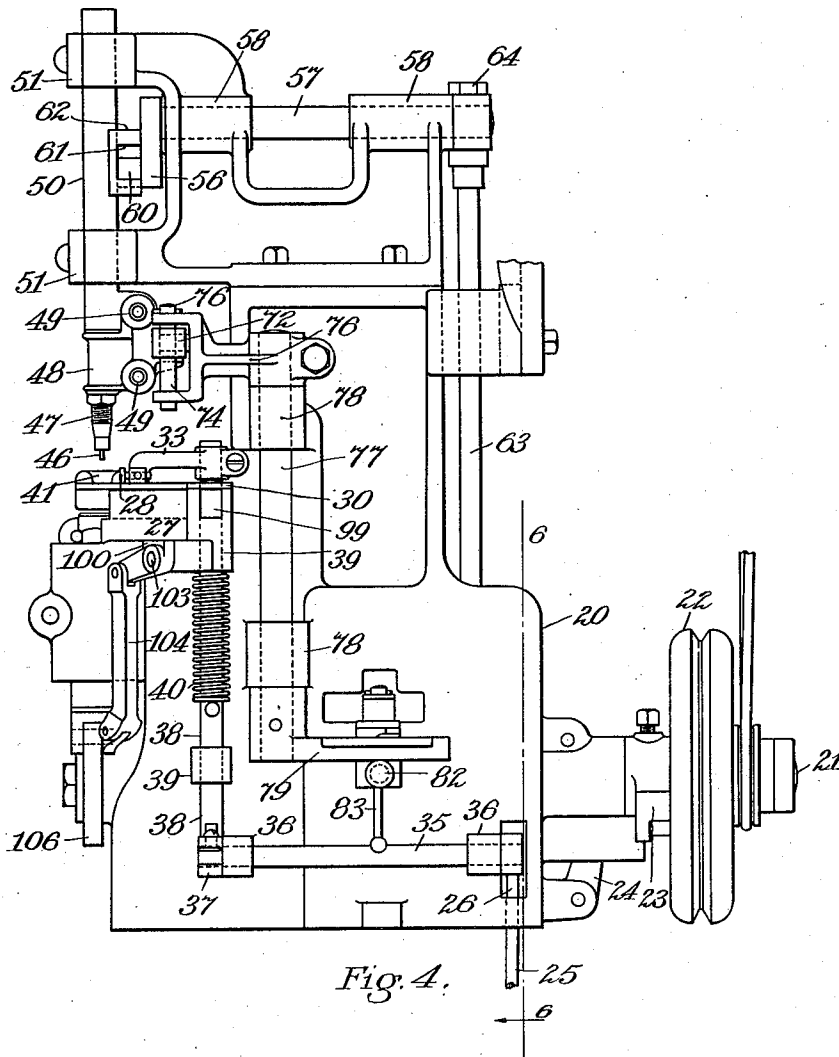
Inventor:
Arthur R. Havener,
by his attorney,
Charles S. Gooding.

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5 SHEETS—SHEET 2.



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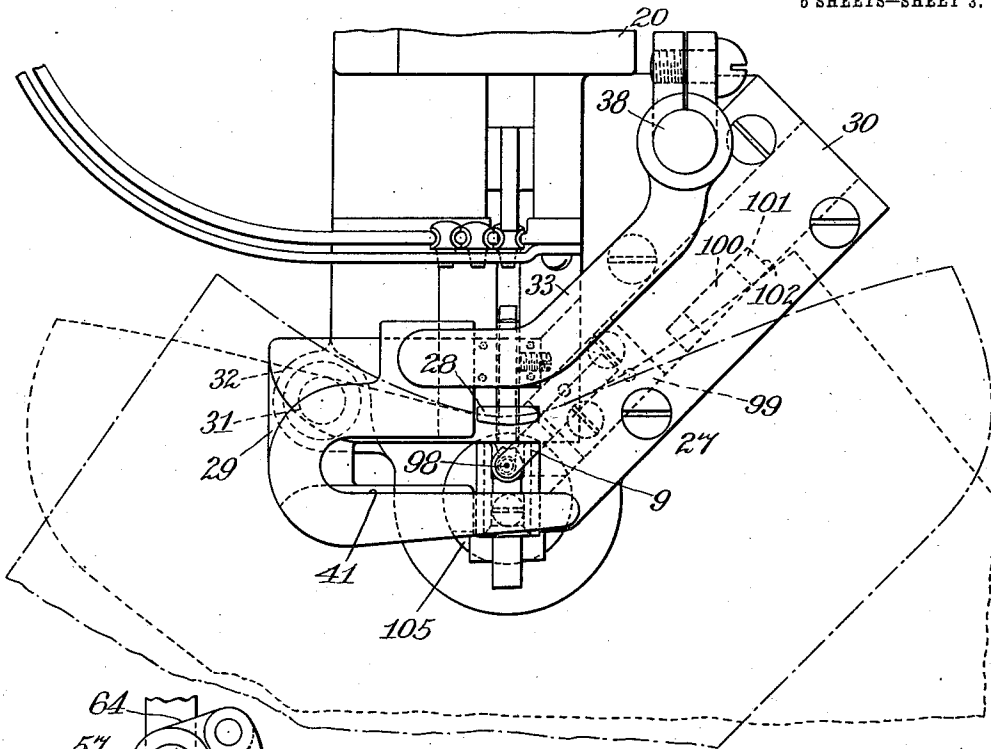


Fig. 5.

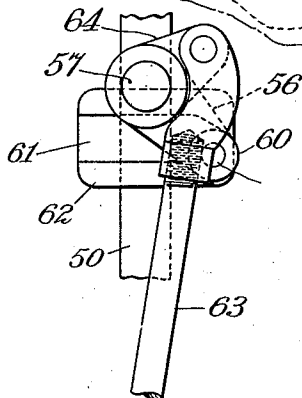


Fig. 7.

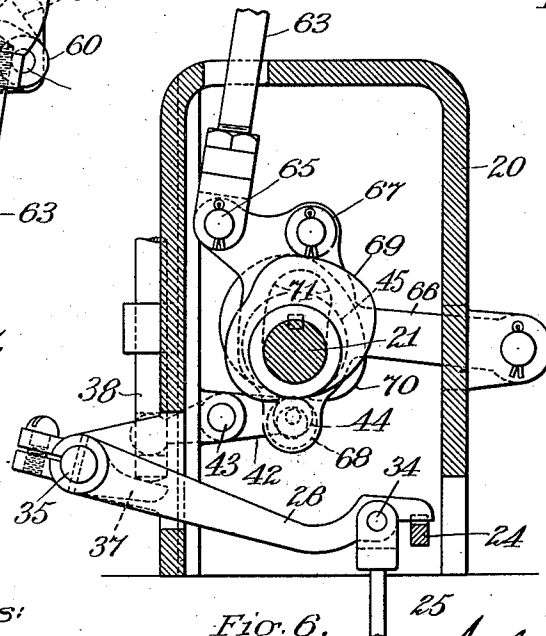


Fig. 6.

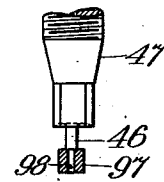


Fig. 8.

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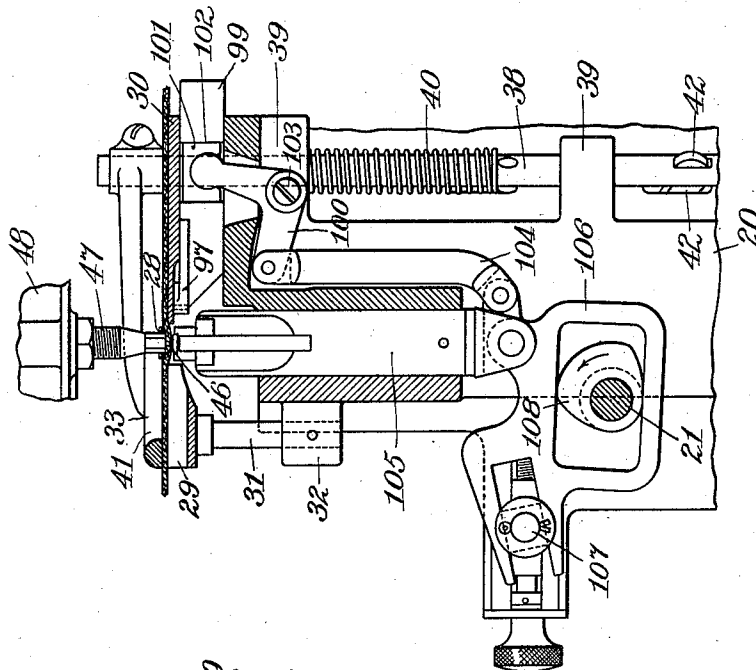


Fig. 10.

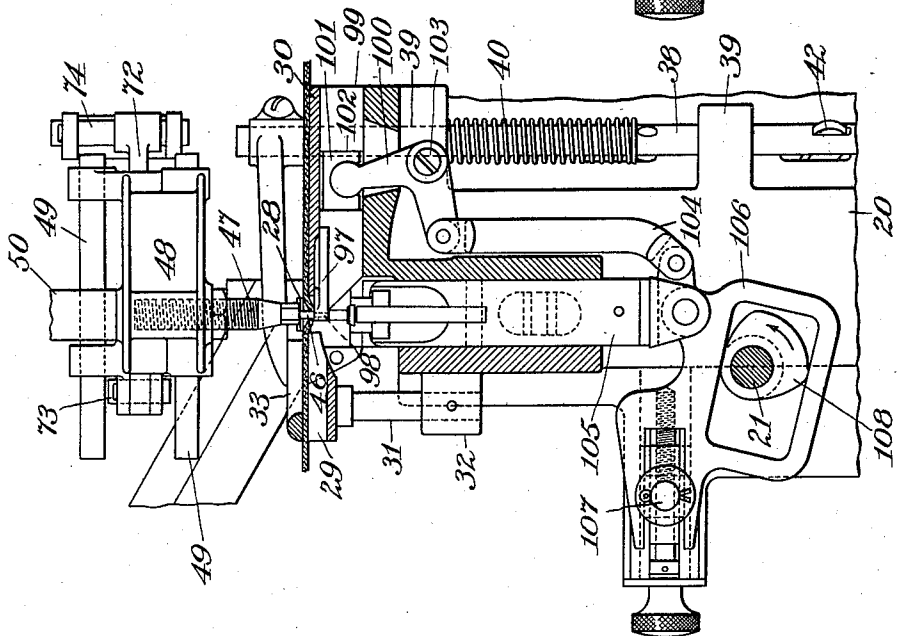


Fig. 9.

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5 SHEETS—SHEET 5.

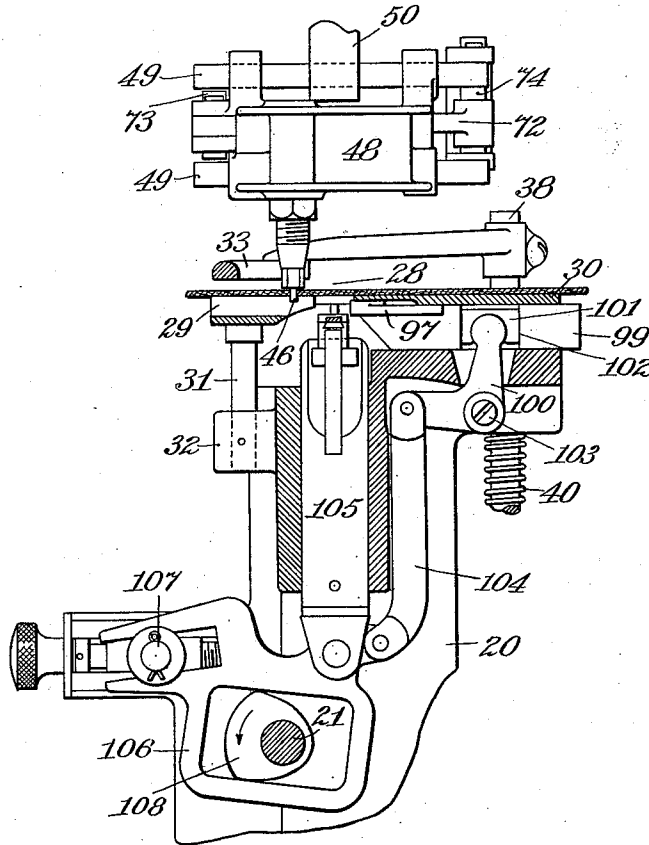


Fig. 11

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UNITED STATES PATENT OFFICE.

ARTHUR R. HAVENER, OF WALTHAM, MASSACHUSETTS, ASSIGNOR TO AMERICAN LACING HOOK CO., A CORPORATION OF NEW JERSEY.

MACHINE FOR PUNCHING AND FEEDING SHEET MATERIAL.

1,019,005.

Specification of Letters Patent.

Patented Feb. 27, 1912.

Original application filed February 28, 1910, Serial No. 546,373. Divided and this application filed November 1, 1910. Serial No. 590,125.

To all whom it may concern:

Be it known that I, ARTHUR R. HAVENER, a citizen of the United States, residing at Waltham, in the county of Middlesex and State of Massachusetts, have invented new and useful Improvements in Machines for Punching and Feeding Sheet Material, of which the following is a specification.

This invention relates to an improved mechanism for punching and feeding sheet material and is especially adapted to punch material which is soft and flexible, such as the leather of the uppers of boots and shoes.

The punch of my invention coöperates with a die plate which preferably has a hole therein, the hole being of smaller diameter than the diameter of the punch, so that the material which is punched from the sheet is forced down into the hole, but the punch does not have to aline exactly with the hole in the die plate, as is the case with punches and dies which coöperate in the punching operation by reason of the punch entering the hole in the die. In the present machine, the punch does not enter this hole and after the punch has descended and forced a small piece of sheet material into the hole in the die, the punch stops at the upper surface of the die plate and the die plate draws away from the punch laterally thereof and out of alinement therewith, thus severing the material which has been removed from the sheet and forced into the hole in the die, as hereinbefore set forth. The sheet material may then be fed by a lateral movement of the punch, the material resting upon a suitable work-support, to which work-support the material is clamped during the punching operation by a suitable clamp which is raised to free the material just before the same is fed by the punch, and which is depressed in time to clamp the material to the work-support just before the punch is moved upwardly or withdrawn from the material.

The invention, then, consists, primarily, in the punch and die by means of which the hole is punched in the sheet material preparatory to the feeding of the same. This construction wherein the punch is of greater diameter than the hole in the die is of great advantage in a machine for feeding flexible and soft sheet material, because it obviates the necessity of having the punch in exact

alinement with the hole in the die during the punching operation, and still such a punch and die for a soft material like leather is equally efficient in the punching operation as is a punch and die in which the punch exactly fits the hole in the die and in which combination, of course, the punch has to be brought in exact alinement with the hole in the die before the punching operation can take place. Furthermore, in a machine of this character and operating in the sequence of movements hereinbefore partially set forth and hereinafter more fully set forth, the lateral movement of the die relatively to the punch or of the punch relatively to the die can take place while the punch is in the sheet material and pressing the punched portion of said sheet material into the hole in the die and when the die is moved laterally of the punch it acts, in conjunction with said punch, to shear off of the sheet material that portion thereof which has been forced out of the same by the punch, and further there is no such liability of dropping the sheet material from the punch prior to the feeding operation as there would be in the case of a punch which has to move upwardly out of a hole in a die prior to the feeding of the sheet material punched thereby, for in such a case it is evident that when the punch has moved upwardly, a piece of thin sheet material is liable to drop off of the end of the punch before said sheet material can be fed by said punch.

The invention further consists in the combination and arrangement of parts set forth in the following specification and particularly pointed out in the claims thereof.

As illustrating one embodiment of my invention I have shown the same in connection with a machine for setting lacing hooks for which I have secured Letters Patent of the United States No. 977,090, patented November 29, 1910, this application being a division of the application upon which said Letters Patent were granted.

Referring to the drawings: Figure 1 is a front elevation of a lacing hook setting machine in which the device of this invention is embodied. Fig. 2 is a detail plan, partly in section, taken on line 2—2 of Fig. 1, illustrating the mechanism for imparting a lateral movement to the punch. Fig. 3 is a detail section, partly in elevation, taken

on line 3—3 of Fig. 2. Fig. 4 is a right hand side elevation of said lacing hook setting machine illustrating my improved punching and feeding mechanism in connection therewith. Fig. 5 is a detail plan of the presser foot, work-support and die, illustrating pieces of sheet material in dotted lines in connection therewith which may be fed by my improved punching and feeding mechanism. Fig. 6 is a sectional elevation taken on line 6—6 of Fig. 4, looking toward the left in said figure and illustrating details of the presser foot operating mechanism and the punch operating mechanism. Fig. 7 is a detail rear elevation of a portion of the punch operating mechanism. Fig. 8 is a detail view of the punch in connection with the die plate, which plate is shown in section. Fig. 9 is a sectional elevation taken on line 9—9 of Fig. 2 illustrating the punching operation. Fig. 10 is a view similar to Fig. 9 illustrating the relative positions of the different parts when the die has moved laterally relatively to the punch. Fig. 11 is a view similar to Fig. 9 illustrating the relative position of the parts after the punch has fed the material forward.

Like numerals refer to like parts throughout the several views of the drawings.

In the drawings, 20 is the frame of the machine and 21 the main driving cam shaft which is driven by means of a clutch pulley 22 which turns loose upon the main driving shaft 21 until locked thereto by a clutch 23 operated in a manner well known to those skilled in the art by means of a clutch lever 24 which is operated by a rod 25 connected to a suitable treadle (not shown in the drawings) and by an arm 26.

The sheet material which is to be punched is placed upon the work-support 27 by the operator, with the front edge of the material resting against a guide or edge gage 28 (Fig. 5). The work-support 27 is made in two parts 29 and 30. The part 29 has a stem 31 extending downwardly therefrom into a boss 32 upon the frame 20 of the machine and is fastened thereto by suitable means, such as a set-screw. The part 30 of the work-support has a plate which is screwed to the frame, as seen in Fig. 5 and extends around and abuts against the upper portion of the part 29, forming a flat surface upon which the sheet material is placed in readiness to be punched and fed. The sheet material is clamped to the work-support by means of a presser foot 33 and this presser foot can be raised by foot from the treadle by means of the rod 25 or the same can be raised and lowered by means of the mechanism which I will now proceed to describe.

Presser foot mechanism.—Referring to Figs. 1, 4, 5 and 6, it will be seen that when the rod 25 is pushed upwardly by its treadle,

referring particularly to Figs. 4 and 6, the upper end of said rod, which is connected by a pin 34 to the arm 26, will push said arm upwardly. The arm 26 is fastened to a rock-shaft 35 journaled to rock in bearings 36, 36 on the right hand side of the frame 20. The rock-shaft 35 has adjustably fastened to its front end an arm 37 and the free end of this arm bears against the bottom of a rod 38 adapted to slide vertically in bearings 39, 39 on the frame 20. A spring 40 presses the rod 38 downwardly. The presser foot 33 is adjustably fastened to the upper end of the rod 38 (Figs. 4 and 5), said presser foot having a slot 41 within which the punch moves during the operation of feeding the sheet material. Thus, it will be seen that when it is desired to raise the presser foot 33 by foot power and by means of the treadle, the rod 25 is pushed upwardly by the treadle raising the arm 26 and the arm 37, and thus pushing the rod 38 upwardly and raising the presser foot 33 which is fastened thereto from the work-support or from the sheet material which rests upon the work-support. The presser foot is always lowered by means of the spring 40 and it is raised automatically by power through the mechanism illustrated in Figs. 4 and 6. Referring to Fig. 6 it will be seen that a lever 42 is pivoted at 43 to the frame 20. This lever has thereon a cam roll 44 which bears against the periphery of the cam 45 fast to the main driving shaft 21 and projects through a slot in the frame of the machine and into a slot in the rod 38 (Fig. 6), so that at the proper time, by its cam 45, the rod 38 will be raised and lowered, thus raising and lowering the presser foot 33 at the proper time to release the sheet material and allow it to be fed forward by the punch after the punch has punched the material and the die has moved laterally with relation to said punch, said presser foot being lowered to clamp the material in position after the feeding operation has taken place and before a new punching operation takes place. The spring 40 presses the rod 38 downwardly and thus, through the lever 42, holds the cam roll 44 against the periphery of the cam 45.

Punch actuating mechanism.—Referring to Figs. 1, 2, 3, 4, 8, 9 and 10 it will be seen that the punch proper 46 is formed upon the lower end of a stud 47 which is screw-threaded to engage a slide 48, constituting a punch holder, guided to slide laterally of the punch upon tubes 48, 49 which are fastened to a plunger or slide 50 arranged to slide vertically in bearings 51, 51 in the frame 20. A vertical reciprocatory motion is imparted to the slide 50 by a crank-arm 56 fast to the end of a rock-shaft 57 journaled to rock in bearings 58, 58 in the frame 20. The crank-arm 56 has a crank-

pin 59 thereon which has a roll 60 journaled thereon and projecting into a slot 61 formed in a block 62 fast to the plunger 50 (Fig. 7). A rocking motion is imparted to the shaft 57 by the mechanism illustrated in Figs. 4 and 6 consisting of a link 63 pivotally connected at its upper end to an arm 64 fast to the shaft 57 and pivotally connected at its lower end 65 to a cam lever 66. The cam lever 66 has journaled thereon two cam rolls 67 and 68. The cam roll 67 bears against a cam 69. The cam roll 68 bears against a cam 70. Both of these cams 69 and 70 are fast to the shaft 21 and the lever 66 is slotted at 71 to straddle said shaft, so that as the shaft 21 is revolved, the lever 66 is rocked upwardly and downwardly in proper time to impart a rocking motion to the rock-shaft 57 by means of the rocker-arm 64. Thus it will be seen that the rocking motion imparted to the rock-shaft 57 through the crank-arm 56 imparts a vertical reciprocatory motion to the plunger 50, and thus the punch is raised and lowered in proper time to punch the material prior to the feeding operation.

Punching and feeding of the sheet material.—A lateral movement is imparted to punch 46 by means of the mechanism illustrated in Figs. 1, 2, 3, 4, 9 and 11. The punch holder 48 is arranged to slide, as hereinbefore set forth, upon the tubes 49, 49 and a sliding movement is imparted thereto by the mechanism illustrated in Figs. 2 and 3 and consisting of a link 72 pivotally connected at 73 to the punch holder slide 48. The opposite end of the link 72 is connected to a pin 74 and is slidable vertically upon said pin. Said link 72 is guided between two ears 75, 75 formed upon and extending rearwardly from the punch holder slide 48. The pin 74 is fastened to an arm 76 (Fig. 4), which, in its turn, is adjustably fastened to a rock-shaft 77 arranged to rock in bearings 78, 78 on the frame 20 and having fastened to its lower end an arm 79 slotted at 80 to receive a pin 81. The pin 81 is gripped to the arm 79 by an eccentric stud 82 which is provided with the handle or arm 83 by means of which it may be rotated so as to perform the gripping operation. A link 84 is pivoted at one end upon the stud 81 and at the other end is pivoted to a stud 85 fast to a cam-slide 86. The cam slide 86 is slotted at 87 to receive a slide-block 88 mounted upon the main driving shaft 21. Two cam rolls 89 and 90 are mounted upon the cam slide 86 the cam roll 89 engaging the cam 91 and the cam roll 90 engaging the cam 92. The cam slide 86 is further guided by a stem or shank 93 arranged to slide in a bearing 94 fast to the frame 20. An index finger 95 is fastened to the stud 81 and moves therewith when the same is adjusted longitudinally of the

slot 80, the outer end of said index finger moving over graduations 96 upon the arm 79. It will be seen that the cams 91 and 92 impart a reciprocatory motion to the cam slide 86 and this, through the link 84, rocks the arm 79, rock-shaft 77 and arm 76, the arm 76 imparting to the punch holder 48 a reciprocatory movement in a direction laterally of the punch by means of the link 72 and thus feeding the sheet material when the punch is inserted therein, and also moving said punch back to its first position after the sheet material has been fed and the punch has been moved vertically by the mechanism hereinbefore set forth out of engagement with said material subsequent to the feeding movement.

Operation of the die.—The die plate 97 has a hole 98 extending therethrough and this hole is of smaller diameter, as hereinbefore set forth, than the diameter of the punch 46, as illustrated in Fig. 8. The die plate 97 is fastened to a slide 99 which is adapted to slide in ways in the frame 20, as clearly illustrated in Figs. 9, 10 and 11. A reciprocatory movement is imparted to said slide by a lever 100 pivoted to the frame 20 and with one arm thereof engaging a slide block 101 located in a slot 102 in said slide 99. The lever 100 is pivoted at 103 to the frame 20 and is connected by a link 104 to a slide 105 to which a reciprocatory motion is imparted by a rocker arm 106 pivoted to a stud 107 adjustably fastened to the main frame, a rocking movement being imparted to the lever 106 by a cam 108 fast to the cam shaft 21. Thus as the cam 108 rocks the arm 106, a rocking movement will be imparted to the lever 100 through the link 104 and thus a reciprocatory movement will be imparted to the slide 99 for the purpose of moving the same laterally with relation to the punch and severing the material which has been pushed into the hole in the die from the main body of the material.

The general operation of the mechanism hereinbefore specifically described, so far as the same relates to the punching and feeding operation, is as follows: The operator presses the treadle in the proper direction to raise the rod 25, rocking the arm 26, rock-shaft 35 and arm 37 so as to lift the rod 38 and thus raise the presser foot 33. The operator then places the sheet material on the work-support 27, as illustrated in the case of a right or left hand upper, in the respective positions illustrated in Fig. 5, with the front edge of the material or upper resting against the edge gage 28. He then releases the treadle and the presser foot descends and is operated to clamp the material to the work-support 27 by the spring 40. The treadle which operates the rod 25 can be rocked in the opposite direction by the operator, and having now placed

the material in position to be punched and subsequently fed, the operator throws the machine into clutch by rocking the treadle in the opposite direction to that in which he
 5 rocked it for the purpose of raising the presser foot, as hereinbefore described, in order that he might insert the sheet material beneath the presser foot and have it clamped to the work-support. The operator
 10 now, therefore, rocks the treadle to lower the rod 25, and by so doing the free end of the arm 26 engages the lever 24 and rocks the same to throw the clutch into engagement with the clutch pulley 22. This causes
 15 the main driving shaft 21 to be operated in order to produce the cycle of movements which will now be described. The punch descends and punches a hole in the leather by coacting with the die plate 97, as herein-
 20 before described and as shown in Fig. 9, where the punch is shown projecting through the material and the hole in the die plate is in alinement with the punch, so that the material punched from the leather can be forced downwardly through said hole. A vertical movement is imparted to the punch by the plunger 50, crank-arm 56 and rock-shaft 57, said rock-shaft having a rock-
 30 ing movement imparted thereto by the mechanism and in the manner hereinbefore fully set forth. After the hole has been punched in the upper as illustrated in Fig. 9 and while the upper is still clamped by the presser foot to the work-support, the die 97
 35 moves back or toward the right (Fig. 9), thus severing the material which has been punched from the upper into the die from the sheet material, and moves from the position illustrated in Fig. 9 to that illustrated
 40 in Fig. 10. The presser foot is at this time raised in order that the sheet material may be fed, and this raising of the presser foot is automatically effected by the mechanism hereinbefore described and consisting of the
 45 rod 38, lever 42 and cam 45. Now the punch and die slide and die being in the relative positions illustrated in Fig. 10, a lateral movement is imparted to the punch while the same is projecting into the sheet material to feed said sheet material the desired
 50 distance, and this lateral movement is accomplished by means of the mechanism hereinbefore described, consisting of the cams 91 and 92, cam slide 86, link 84, arm
 55 79, rock-shaft 77, arm 76, link 72 and punch holder slide 48, said punch holder slide sliding on the tubes 49, 49, thus moving the sheet material toward the left to the position illustrated in Fig. 11. When the punch
 60 has fed the material as hereinbefore described and as illustrated in Fig. 11, the presser foot is automatically lowered to clamp the work to the work-support. The punch now moves upwardly out of the ma-
 65 terial and then moves laterally to its first

position, as in Figs. 1 and 4, in readiness to descend, and the cycle of operations hereinbefore described is then repeated to punch the material and feed the same.

By setting the stud 81 at different points
 70 along the slot 80, toward or away from the rock-shaft 77, the throw of the arm 76, and, through the link 72, the throw of the punch holder slide 48 and of the punch attached thereto, will be increased or diminished, re-
 75 spectively, and as the slot 80 is formed on a circle concentric with the pivot 85 of the link 84, when the parts are in the position illustrated in Fig. 2, or when the punch is at the extreme right of its movement ready
 80 to descend into the material, it is evident that any change in the throw of the punch and, therefore, in the feed of the material, will take place entirely at the extreme left of the movement of the punch, as viewed in
 85 Fig. 1 or Fig. 2, and that said punch will always be brought back to the same point, viz., in substantial alinement with the hole in the die, no matter what the throw may be which is given to it by the mechanism here-
 90 inbefore described.

The principal advantages derived from the construction and operation of the punching and feeding mechanism are that the punch, after punching a hole in the material, does not necessarily move upwardly
 95 until the feeding operation has been performed, and thus the punch remains projecting into the material and feeds the material without buckling or becoming dis-
 100 engaged therefrom in the feeding, so that the material is always fed the distance desired with accuracy.

The principal advantage of the specific construction of the punch and die in which
 105 the diameter of the punch is larger than the diameter of the hole in the die consists in the fact that while a piece of leather can be punched out of an upper into the hole in the die, it is not necessary to exactly aline the
 110 punch with the hole in the die, and, moreover, it is unnecessary to move the punch upward before the die can be moved laterally with relation thereto in order to cut the leather piece which has been punched there-
 115 into from the main part of the material. Another advantage obtained by the construction hereinbefore set forth is found in making possible the high speed at which the machine can be operated in the con-
 120 struction and operation of the punch and its horizontal and vertical carrying means. The vertical movement of the punch is very much less than the lateral movement there-
 125 of, and, therefore, if the part to which the punch is attached and to which a lateral movement is imparted, can be made comparatively light and small compared with that part which imparts the vertical move-
 130 ment to the punch, a resulting improvement

in possible speed of the feed of the material will be obtained, and in the machine of this invention this result is obtained by attaching the punch to a light and comparatively small slide piece, viz., the piece 48, which is the slide to which the punch is directly fastened and to which a lateral movement for the feeding of the material is imparted, while the vertical movement of the punch, which, as before stated, is slight as compared with the lateral movement, is imparted by the comparatively large and heavy means, viz., the plunger slide 50.

It is evident that while the punch 49 and the hole 98 in the die 97 are shown in the drawings as cylindrical and are referred to in the claims in terms of diameters, yet said punch and the hole might be of other shape than cylindrical, such, for instance, as elliptical or polygonal in cross section without departing from the spirit of my invention.

While applicant has shown his invention and described the same as embodied in a machine in which a lateral movement is imparted to the die and to the punch relatively to each other, still it is to be distinctly understood that he does not limit his invention to a machine in which the punch has a movement laterally with relation to the die or the die has a movement laterally with relation to the punch or both punch and die have motions laterally with relation to each other, for the punch of larger diameter than the hole in the die is capable of producing a new and useful result independent of said lateral movement. The punch of larger diameter than the hole in the die will punch a piece of material out of a sheet of the same and cleanly cut it out of connection with said sheet and force said piece so cut into the hole in the die without a lateral movement being imparted to either the punch or the die.

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

1. A machine for punching sheet material having, in combination, a punch and a die having a hole therein of less diameter than said punch and adapted to cooperate with said punch to punch a hole in said sheet material.

2. A machine for punching sheet material having, in combination, a punch, a die having a hole therein of less diameter than said punch and adapted to cooperate with said punch to punch a hole in said sheet material, and mechanism adapted to move said die laterally relatively to said punch.

3. A machine for punching sheet material having, in combination, a punch and a die having a hole therein of less diameter than said punch and adapted to cooperate with said punch to punch a hole in said sheet ma-

terial, and mechanism adapted to move said die laterally relatively to said punch in one direction, and mechanism adapted to subsequently move said punch laterally thereof in another direction.

4. A machine for punching and feeding sheet material having, in combination, a work-support, a punch located above said work-support, a die located beneath said support having a hole therein of less diameter than said punch adapted to cooperate with said punch to punch a hole in said sheet material, means adapted to move said punch toward said die and mechanism adapted to move said die laterally relatively to said punch while said punch is projecting into said sheet material, whereby the material forced by said punch into said hole may be severed from said sheet material.

5. A machine for punching and feeding sheet material having, in combination, a slide, mechanism adapted to impart a vertical reciprocatory motion thereto, a punch, a die having a hole therein of less diameter than said punch, a holder for said punch, said holder adapted to move horizontally on said slide and mechanism adapted to move said holder on said slide.

6. A machine for punching and feeding sheet material having, in combination, a slide, mechanism adapted to impart a vertical reciprocatory motion thereto, a punch, a die having a hole therein of less diameter than said punch, the vertical median line of said punch being adapted to substantially align with the vertical median line of said slide, a holder for said punch adapted to move horizontally on said slide, and mechanism adapted to move said holder on said slide, whereby the vertical median line of said punch may be brought into and out of alinement with the vertical median line of said slide.

7. A machine for punching and feeding sheet material having, in combination, a slide, mechanism adapted to impart a vertical reciprocatory motion thereto, a punch, a die having a hole therein of less diameter than said punch, a holder for said punch, said holder adapted to move horizontally on said slide, mechanism adapted to move said holder on said slide a predetermined distance from a given point and back to said point, and means to vary the distance to which said holder may be moved from said point.

8. A machine for punching and feeding sheet material having, in combination, a slide, mechanism adapted to impart a vertical reciprocatory motion thereto, a punch, a die having a hole therein of less diameter than said punch, a holder for said punch, said holder adapted to move horizontally on said slide, a lever, a cam slide, and a cam adapted to move said cam slide, a link con-

necting said cam slide to said lever, and a link connecting said lever to said punch holder.

9. A machine for punching and feeding
 5 sheet material having, in combination, a slide, mechanism adapted to impart a vertical reciprocatory motion thereto, a punch, a die having a hole therein of less diameter than said punch, a holder for said punch,
 10 said holder adapted to move horizontally on said slide, a lever connected to said holder, a cam slide, a cam adapted to move said cam slide, a link, a pivot by which one end of said link is connected to said cam
 15 slide, a stud pivotally connecting the other end of said link to said lever and extending through a slot in said lever, the said slot concentric with said pivot when said punch is in alinement with the hole in said die,
 20 whereby said punch may be moved a predetermined distance out of alinement with the hole in said die and back into alinement therewith and the distance to which said punch may be so moved may be varied.
- 25 10. A machine for punching sheet material having, in combination, a punch and a die having a hole therein of less diameter than said punch and adapted to cooperate with said punch to punch a hole in said

sheet material and mechanism adapted to
 30 move one of said parts laterally relatively to the other.

11. A machine for punching sheet material having, in combination, a punch and a die having a hole therein of less diameter
 35 than said punch, the relative diameters of said punch and die being such that said punch may punch a piece from said sheet material and force the piece so punched into said hole.

12. A machine for punching sheet material having, in combination, a punch, a die adapted to support a piece of sheet material, said punch being of less diameter
 40 than the width of said piece of sheet material, said die having a hole therein of less diameter than that of said punch, whereby said punch may cooperate with said die to punch
 45 a piece out of said sheet material and force said piece into the hole in said die.

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

ARTHUR R. HAVENER.

Witnesses:

CHARLES S. GOODING,
 LOUIS A. JONES.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."