

M. D. PHELAN

MACHINE FOR OPERATING ON SHEET MATERIAL

Filed March 5, 1929

2 Sheets-Sheet 1

Fig. 1.

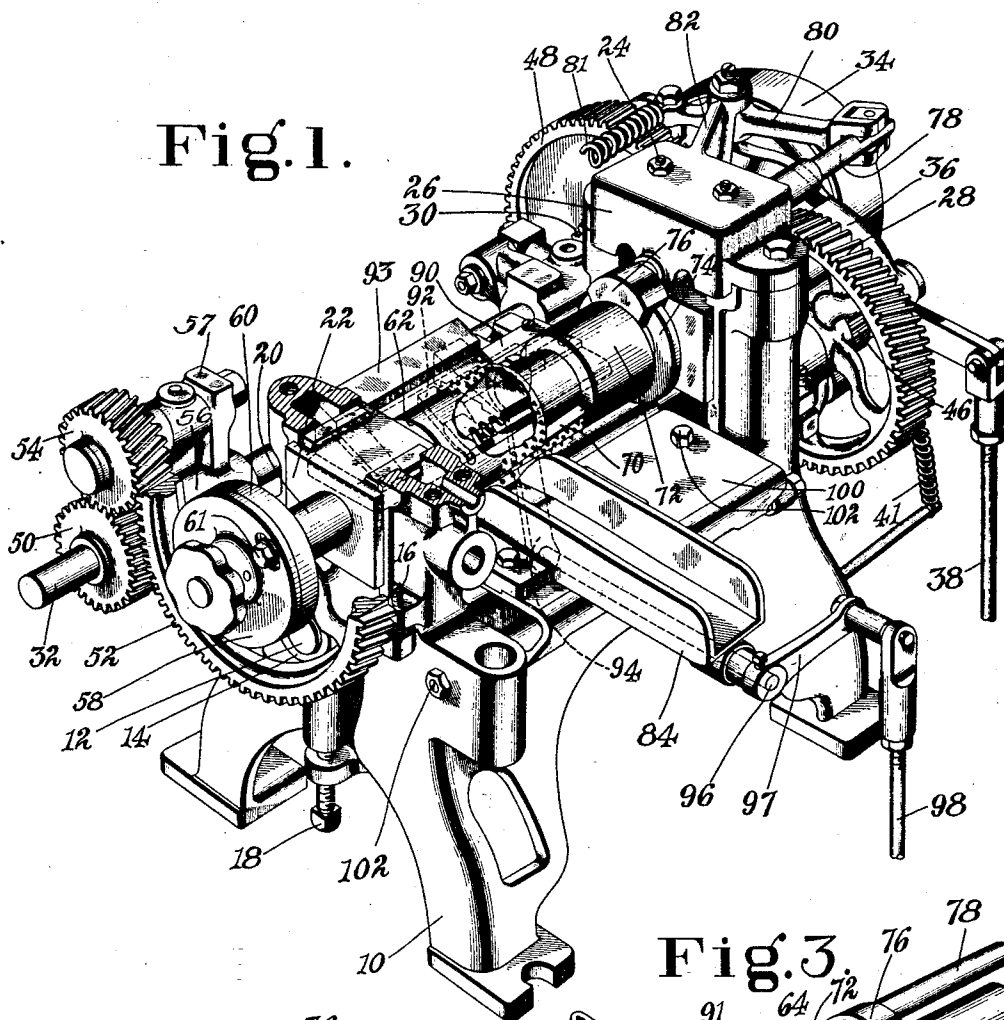


Fig. 2

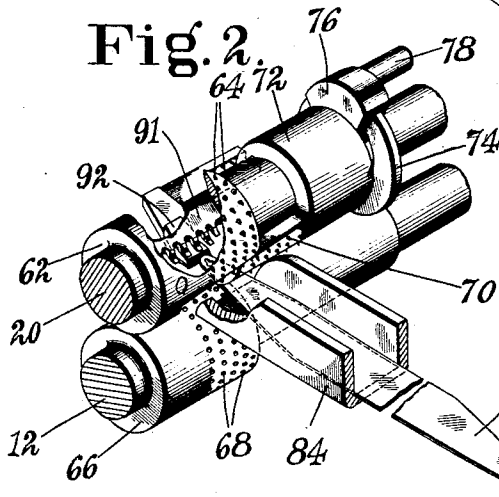
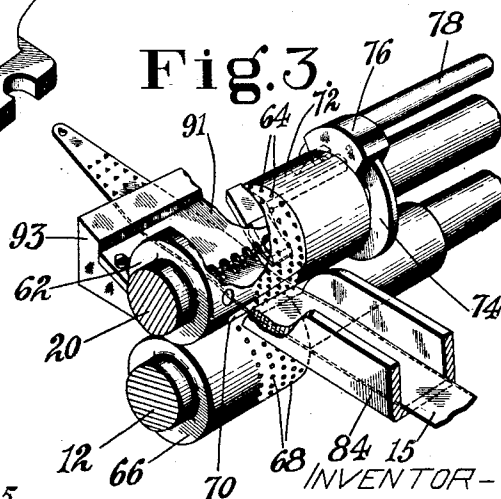


Fig. 3



70 68 INVENTOR-
Merton D. Phelan
By His Attorney,
Harlow M. Davis

June 6, 1933.

M. D. PHELAN

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2 Sheets-Sheet. 2

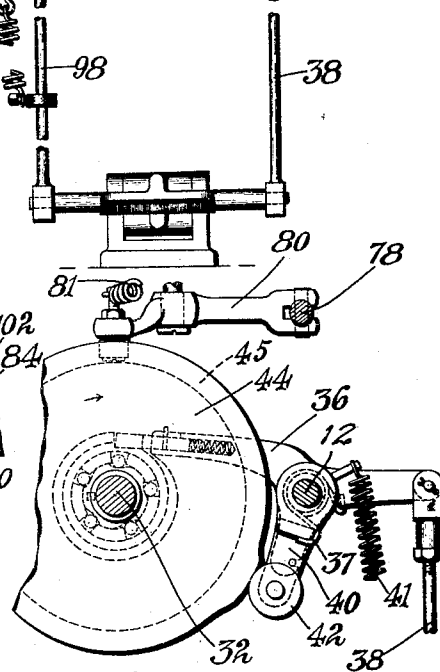
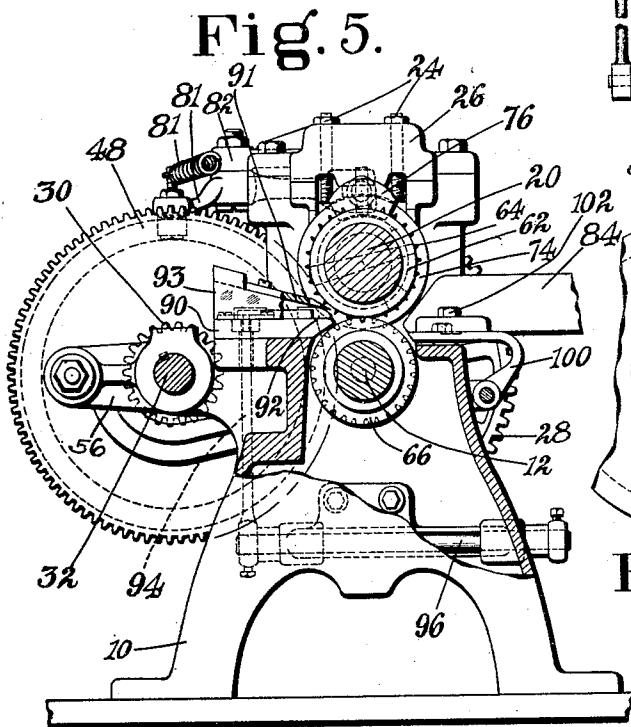
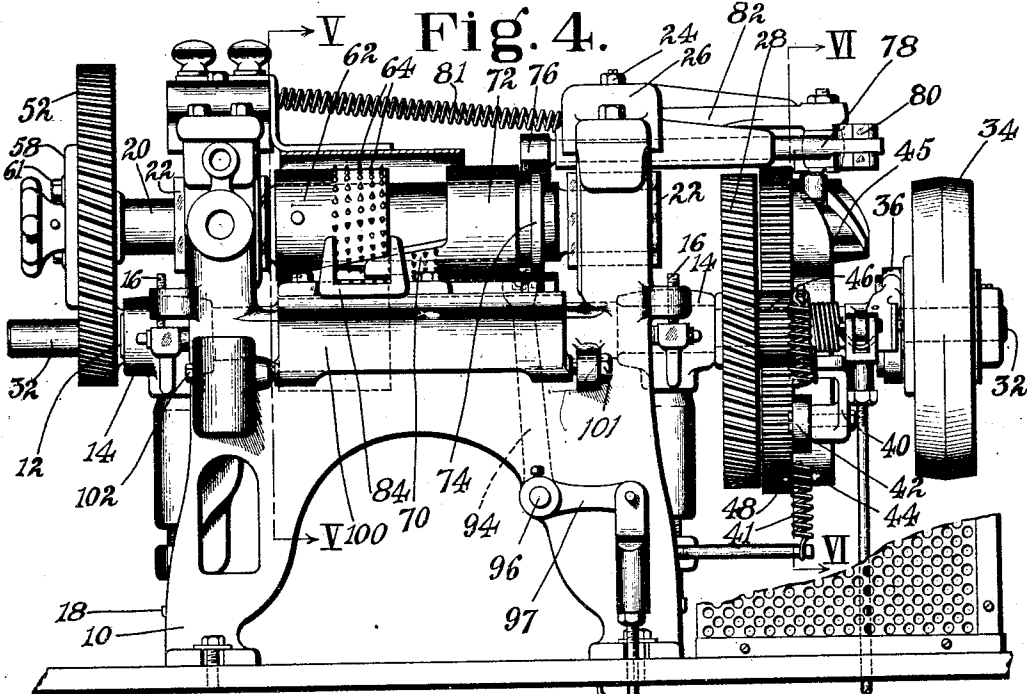


Fig. 6. INVENTOR-
Merton D. Phelan
By his Attorney,
Harlow M. Davis

UNITED STATES PATENT OFFICE

MERTON D. PHELAN, OF BEVERLY, MASSACHUSETTS, ASSIGNOR TO UNITED SHOE MACHINERY CORPORATION, OF PATERSON, NEW JERSEY, A CORPORATION OF NEW JERSEY

MACHINE FOR OPERATING ON SHEET MATERIAL

Application filed March 5, 1929. Serial No. 344,411.

This invention relates to machines for operating on sheet material in performing an extended operation or a series of recurring operations thereon, such, for example, as marking, perforating, corrugating, die-forming, or the like.

In one aspect, the invention comprises a machine having the capacity of treating a selected or measured intermediate portion of an elongated strip, or of subjecting a portion of a strip to a series of operations begun at an intermediate point in the length of the strip.

One important field of use for the invention is in the preparation of sheet steel strips for grating or abrading the bottoms of boots and shoes preparatory to the reception of the sole. These strips are provided with a series of sharp edge projections by being perforated and having the metal adjacent to the perforations drawn outwardly by a die-forming operation. Such strips are subsequently wound into a cylindrical form and used as a rotary abrading tool. For purposes of illustration, the present invention will be described in its application to the production of such grater strips.

I have discovered that a compact and efficient machine for forming perforated strips is provided by employing a rotary tool member and a cooperating member constructed and arranged to engage the strip between them and to act progressively thereon, one of said members having a tool-carrying section displaceable to permit the strip to be presented in position between the two members and then after the operation has begun restored to operative position. This permits the manufacture of a strip having any desired end-margin and any desired length, even, if desired, a length greater than the periphery of the rotary tool. This is because the blank strip may be inserted between the rotary tool and its cooperating member to any desired predetermined position by taking advantage of the space afforded by the displacement of such portion or section. When, therefore, the tool is rotated, the operation begins upon the strip at a gauged intermediate point predetermined in accordance with the requirements of the work.

As herein shown, and in accordance with another feature of the invention, the section which is initially displaced is arranged to be automatically restored to its operative position after the rotary tool has turned sufficiently to maintain the section out of contact with the work and before it is carried again into operative position. In other words, that portion of the periphery of the rotary tool which is incomplete when its rotation begins is completed by restoring the section to its operative position before the tool carries it into engagement with the work. By this arrangement, a strip treated may be of a length equal to any multiple of the length of the periphery of the rotary tool, the removable section being maintained in place for any predetermined number of consecutive rotations. If it is desired to form a strip with end margins at both ends, the movement of the displaceable section is effected during the first and the last rotation of the tool upon the strip but it will be apparent that if an intermediate blank should be required in the strip, this may be secured by an intermediate displacement of the section during an intermediate rotation of the tool.

An important feature of the invention consists in the combination of rotary tools, one of which has a displaceable operative section, with starting and stopping mechanism acting to stop the tools when the section is displaced or, more broadly, operating in timed relation to the shifting of the replaceable section either into or out of operative position. This feature contributes to the design of an efficient and automatic machine and relieves the operator of the necessity of presenting the work in timed relation to the machine.

Another advantage incident to the employment of a displaceable section in one of the cooperating work engaging members is that the work may be presented directly to a gauge located beyond the initial point of engagement of the tools with the work or, if rotary tools are employed, upon the delivery side of the tools. In this connection, another feature of the invention consists in a gauge arranged to be positioned initially in the path

of the work which is arranged to be automatically shifted to an inoperative position in timed relation to the action of the work-feeding tools and of the movement of the replaceable tool section. This arrangement facilitates an accurate presentation of the work to the machine and affords a clear passage for the work after it has once been located and the tools brought into operation.

These and other features of the invention will be best understood and appreciated from the following description of a preferred embodiment thereof, selected for purposes of illustration and shown in the accompanying drawings, in which

Fig. 1 is a view in perspective of the machine;

Fig. 2 is a view in perspective of the rotary tools, showing the work in initial position against a gauge;

Fig. 3 is a similar view, showing the work in process of passing between the tools;

Fig. 4 is a view of the machine in front elevation;

Fig. 5 is a view of the machine in cross section upon the line 5—5 of Fig. 4; and

Fig. 6 is a view in elevation of the clutch mechanism and associated parts, with the shaft in section.

The machine herein illustrated is intended for operating upon a long narrow strip of steel to form therein a series or rows of sharp-edge projections. One of the blank strips 15 is shown in Fig. 2 and the same strip partially completed is shown in Fig. 3. The blank strip is oppositely tapered at its ends and provided with a keyhole slot by which it is subsequently secured in the cylindrical frame in which it is used as a grater. The individual projections are formed by perforating the metal of the strip and then drawing it outwardly adjacent to the perforation so that its sharp edges are raised above the plane of the strip. This is effected by a combined perforating and die-shaping operation performed by rotary tools having cooperating perforating projections 64 and corresponding recesses 68 and acting as feed rolls, to advance the work.

The machine frame 10 has oppositely disposed upwardly-extending branches at either side which are forked to receive the bearings for the upper and lower roll shafts. Of these, the lower shaft 12 has bearings 14 which are adjustable vertically, being confined between adjustable stop screws 16 above and adjustable stop screws 18 below. The upper roll shaft 20 has bearing boxes 22 held normally upwardly by springs, not shown, against adjustable stop screws 24 which project downwardly through cap pieces 26 secured to each branch of the frame.

The lower shaft 12 is driven and for this purpose is provided at its right end, as shown in the drawings, with a skew gear 28 which

meshes with a pinion 30 pinned to a countershaft 32 journaled behind the shaft 12 and at substantially the same level. The countershaft 32 is provided at its outer end with a driving pulley 34 and clutch mechanism is interposed between the pulley 34 and the shaft 32. The clutch mechanism is automatically controlled to impart a predetermined number of revolutions to the shaft 32 each time it is tripped.

As shown in Fig. 6, the clutch itself is of the well-known Horton type, being tripped by a swinging arm 36, fulcrumed upon the outer end of the shaft 12 and connected to the upper end of a vertical treadle rod 38. A second arm 40, also fulcrumed upon the shaft 12, is connected to the tripping arm 36 by a stiff torsion spring 37 and acted upon by a tension spring 41 which tends always to swing it with the tripping arm 36 into clutch-disengaging position, that is to say, in the same direction the tripping arm is moved by the depression of the treadle rod. The arm 40 carries a cam roll 42 at its outer end which runs upon the periphery of a cam disk 44 loose on the countershaft 32. The cam disk 44 has an elevation at one point in its periphery which acts to swing the arm 40 positively outwardly and return the tripping arm 36 to clutch-engaging position at the proper time in the cycle of the machine and against the tension of the spring 41. It will be understood that the initial tripping movement of the arm 36 by the treadle rod takes place against the action of the torsion spring 37 and that thereafter the tripping arm is held out by the spring 41 until the action of the latter is overcome by the movement of the arm 40 by the cam disk 44.

Fast to the hub of the skew gear 28 is a pinion 46 meshing with a large gear 48 loose on the countershaft 32 and secured to the cam disk 44 and, consequently, driving it at a reduced speed compared to the roll shaft 12. As herein shown, the gear ratio is such as to cause the cam disk 44 to make one revolution while the roll shaft 12 makes five revolutions.

The countershaft 32, driving the lower roll shaft 12 through the pinion 30, carries at its left-hand end a similar pinion 50 (Fig. 1) which, through an idle gear 54, drives a skew gear 52 on the left end of the upper roll shaft 20. The countershaft 32 is journaled in arms 56 (Fig. 5) which extend rearwardly from the machine frame and constitute parts thereof. The left-hand arm 56 is extended upwardly at 57 (Fig. 1) and carries a stationary shaft for the idle gear 54. The gear 52 is loose upon the shaft 20 but is provided with a hub 60 which is connected by bolts 61 to a disk 58 fast to the end of the shaft. The bolts 61 pass through circumferentially extending slots in the disk 58 which permit angular adjustment of the shaft

20 with respect to the gear 52 and, consequently, with respect to the lower roll. Provision is thus made for effecting an angular adjustment of the two rotary tools to cause
 5 the projecting elements 64 to register accurately with the corresponding recesses 68 so that the two will intermesh.

The tools of the illustrated machine comprise rolls or cylinders, of which the upper
 10 roll 62 carries projecting punching or perforating elements 64 and the lower roll 66 is provided with cooperating recesses or die cavities 68. The lower roll 66 comprises a sleeve fast upon the lower shaft 12, integral
 15 in construction and having its right-hand portion (Fig. 2) of reduced diameter.

The upper roll 62 comprises a main body or sleeve which is pinned fast to the upper shaft
 20 20 and a sliding sector-like section 70 extending about 60° circumferentially of the sleeve and in length for the full effective length of the roll. Each of these carries projecting
 25 elements 64. The main sleeve of the roll 62 is cut away to receive the sliding section 70 and when the latter is in operative position it completes the cylindrical area of the roll. When it is moved axially to its inoperative
 30 position it leaves a sector-like gap or opening in the periphery of the body sleeve of the roll which materially lessens the radius of said
 35 body and leaves a space between the two rolls permitting the work to be presented in position between them.

The sliding section 70 forms part of a
 35 sleeve 72 arranged to slide longitudinally on a reduced portion of the upper roll. The circumferential position of the sliding section 70 is controlled at all times as it never becomes completely disengaged from the opening
 40 in the main portion of the roll 62 and is always guided by the parallel walls thereof. The perforating members 64 are disposed in rows in the roll 62 obliquely to its axis and, consequently, the walls of the sliding section
 45 70 and of the opening in the roll are correspondingly inclined. At its right-hand end the sleeve 72 has a flange 74 which engages a curved groove in the head 76 of a shifting
 50 member having a shaft or stem 78 (Figs. 3 and 4) which is guided for longitudinal movement in bearings formed in the cap 26 of the right-hand branch of the frame. At its outer
 55 end the shaft 78 has a sliding block connection (Fig. 1) with a cam lever 80 fulcrumed upon an arm 82 projecting outwardly from the cap 26. At its rear end the cam lever 80
 60 carries a cam roll which runs in a cam track formed in the periphery of the cam disk 44. The cam track is incomplete, as shown in Fig. 4, and a tension spring 81 is provided which acts on the cam lever 80 to hold the roll at
 65 all times against the wall of the cam disk. The cam track 45 is so disposed as to shift the sliding section into place during the first revolution of the roll 62 and out of place dur-

ing the fifth revolution thereof, the clutch acting to stop the machine with the sliding section displaced, as shown in Fig. 4.

The purpose of the displacement of the
 70 sliding section 70 is to form a gap in the circumferential extent of the periphery of the body sleeve of the roll to permit a work piece to be inserted between the two rolls so that the cooperating tool elements will act first at
 75 an intermediate point on the work and not upon its advancing end as they would if the work were presented to rolls having each a complete periphery. It also permits the work
 80 piece to be gauged as to its initial position while located between the rolls.

A displaceable gauge is located close behind the rolls where it may be engaged by the entered end of the work piece. The gauge
 85 comprises the end surface of an arm 92 (Figs. 2 and 5) which is carried by a block mounted to slide transversely in a plate 90 bolted to the machine frame behind the rolls. The gauge block is moved back and forth by an
 90 arm 94 (Fig. 4) secured to the rear end of a shaft 96 (Fig. 5) journaled in the lower part of the frame 10 and having at its forward end a treadle arm 97 (Fig. 4) connected in
 95 turn to a treadle rod 98. Both the treadle rods 98 and 38 are connected to the same treadle so that, when the treadle is depressed to trip the clutch and start the machine, the
 100 gauge arm is shifted laterally to the right to an inoperative position out of range of the advancing work. When the machine stops and the treadle is free to rise, a tension spring
 105 99 connected to the treadle rod 98 acts to swing the arm 94 toward the left and return the gauge 92 to its initial operative position.

A stripper is provided for removing the
 110 work from the punching elements of the upper roll 62 and preventing it from following about the roll. This comprises an obliquely disposed beveled plate 91 (Fig. 5) located close to the rolls and just above the gauge
 115 92 when the latter is in its operative position. The gauge plate 91 is carried by a block 93 bolted in place upon the plate 90. It will be understood that the work piece passes beneath the stripper plate as it emerges from the
 120 rolls.

In front of the rolls the machine frame carries an angularly adjustable bed plate 100
 125 supported by cone-pointed screws 101 (Fig. 4) which extend through lugs in the machine frame. Adjusting bolts 102 maintain the inner edge of the bed plate in the proper position with reference to the bite of the rotary tools. A work guiding member, comprising a narrow trough 84, is secured to the bed
 130 plate and movable with it, serving to position the blank strip as presented to the machine and guide it in a path at right angles to the axis of the rolls.

The operation of the machine will be apparent from the foregoing description but

may be summarized as follows. The cam 44 acts to bring the machine to rest in the position shown in Figs. 1, 2 and 4, with the section 70 displaced toward the right and the gauge 92 in its left-hand position opposite the gap in the upper roll. The work is presented in the trough 84 and advanced between the rolls until it encounters the gauge 92. The operator then depresses the treadle, simultaneously tripping the clutch and moving the gauge 92 toward the right out of the path of the work. The rolls 62 and 66 are immediately set in rotation and the perforating projections 64 of the upper roll, initially located on the front side of the roll and behind the gap, are moved to engage the work and perforate it in cooperation with the recesses 68 of the lower roll. As the upper roll turns, carrying the gap upwardly away from the work, the cam track 45 acts to shift the section 70 toward the left until it completely fills the gap in the upper roll and completes its periphery. With the section 70 thus held in its operative position, the rolls continue to make five revolutions. During the fifth revolution of the rolls and after the section 70 has acted upon the work strip, the cam track 45 shifts the section again toward the right into its inoperative position and the rolls are brought to rest by the action of the cam 44 when the gap in the roll 62 is again located at the bottom of the roll. This occurs when the strip 15 has been carried to a point which leaves substantially the same end margin at its rear end as provided at its forward end. With the machine stopped in this position, the work is released by the rolls and the completed strip is free to be withdrawn by the operator.

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

1. A machine for operating on sheet material, having in combination, a rotary tool member comprising a support and peripherally disposed projecting tools and a cooperating member comprising a support having recesses to receive the tools, said members being constructed and arranged to engage a work piece between them and to act progressively thereon, one of said members having a peripheral portion of its support mounted for movement axially out of alignment with adjacent portions of the periphery of the member to permit the work to be presented in position between the two members.

2. A machine for operating on sheet material, having in combination, cooperating members constructed and arranged to grip a work piece between them and to act progressively thereon, one of said members comprising a rotary tool having a section of its periphery displaceable axially thereof to provide clearance for work to be presented

in position between the member and its cooperating member.

3. A machine for operating on sheet material, having in combination, cooperating members constructed and arranged to engage a work piece between them and act progressively thereon, one of said members comprising a cylindrical tool body with circumferentially disposed operating elements and having an element carrying section mounted for movement with its associated elements axially of the tool body thereby lessening the radius of a portion of the body of the tool to form a gap in its periphery which will permit the work to be presented in position between the two members.

4. A machine for operating on sheet material, having in combination, cooperating members constructed and arranged to engage a work piece between them and to act progressively thereon, one of said members comprising a plurality of sector-like sections forming a cylindrical tool with circumferentially disposed operating elements, one of the sections being mounted for movement axially with its associated elements to form a gap in the circumferential extent of the periphery of the tool.

5. A machine for operating on sheet material, having in combination, cooperating cylindrical tools constructed and arranged to engage a work piece between them and to act progressively thereon, one of said tools having a section mounted to permit displacement, driving mechanism, and means for controlling the position of said section automatically in timed relation to the starting and stopping of the tools.

6. A machine for operating on sheet material, having in combination, rotary tools constructed and arranged to engage a work piece between them and to act progressively thereon, one of said tools having a displaceable operative section, means to displace said section periodically, and starting and stopping mechanism co-acting with said means to stop the tools during a period when the section is displaced and to rotate the tools during a period when the section is restored to its operative position.

7. A machine for operating on sheet material, having in combination, rotary tools shaped to act upon opposite sides of a work piece, one of said tools having a displaceable operative section, mechanism for driving the tools and shifting said section acting in timed relation to impart a predetermined number of rotations to the tools while said section is maintained in its operative position and thereafter to displace said section.

8. A machine for operating on sheet material, having in combination, rotary tools adapted to engage a work piece between them, one of said tools having a section initially displaced, a cam for shifting said section,

and associated driving mechanism acting to impart a predetermined number of complete revolutions to the tools between successive movements of said section to and from operative position.

9. A machine for operating on sheet material, having in combination, rotary tools adapted to engage a work piece and including an operative section initially displaced to permit the insertion of the work piece between the tools, means for rotating the tools to carry said section away from the work, and means for shifting said section into operative position during such rotation.

10. A machine for operating on sheet material, having in combination, rotary tools adapted to engage a work piece, one of said tools having a gap in its periphery and an operative section movable to close said gap, means for starting and stopping said tools while the gap is open, and means for closing the gap during the rotation of the tools.

11. A machine for operating on sheet material, having in combination, rotary work feeding members, one having an operative section movable to form a gap to permit the work to be inserted freely between the feeding members, driving mechanism, and automatic means operating during rotation of said members for shifting said section to and from operative position while it is out of contact with the work.

12. A machine for operating on sheet material, having in combination, rotary work feeding members for gripping a work sheet therebetween, one having an operative section movable to form a gap to permit the work to be initially positioned between the feeding members, driving mechanism, and automatic means associated therewith for moving said section into operative position, maintaining it there for a predetermined number of revolutions and then displacing it to interrupt the feeding action of said rotary members.

13. A machine for operating on sheet material, having in combination, rotary work feeding members, a gauge located at the rear of said members, one member having an operative section arranged to be displaced to permit the work to be passed freely between the feeding members and into contact with the gauge, and means operated during rotation of the members for thereafter restoring said section to operative feeding position.

14. A machine for operating on sheet material, having in combination, rotary work feeding members, a gauge located upon the delivery side of said members, one member having an operative section arranged to be displaced to permit the work to be presented to the gauge independently of the feeding members, and automatic means for restoring said section to its operative position at a predetermined point in the rotation of its associated feeding member.

15. A machine for operating on sheet material, having in combination, feed rolls, a gauge located initially in the path of work leaving said rolls, one of the latter having a section displaceable to form a space which will permit the work to be moved through the rolls into contact with the gauge, means for simultaneously removing the gauge and starting the rolls, and means operated during the rotation of the rolls for replacing said section in its roll.

16. A machine for operating on sheet material, having in combination, a pair of cooperating feed rolls, one having its periphery incomplete initially on the side toward the other roll, driving means for the rolls, and means for completing said periphery after the roll is set in motion so that it may act continuously to feed the work during its entire subsequent rotation.

17. A machine for operating on sheet material, having in combination, a pair of perforating rolls having cooperating projecting elements and recesses which intermesh during the rotation of the rolls, one of said rolls having a sector-like section carrying a projecting element and being movable on the said roll to and from operative position while disengaged from the recesses in the other roll.

18. A machine for operating on sheet material, having in combination, a pair of perforating rolls having tools and being rotatable in intermeshing relation, one roll having a tool-carrying section movable to and from operative position, and means for automatically shifting said section axially of the rolls while in position remote from its associated roll.

19. A machine for operating on sheet material, having in combination, a pair of intermeshing rotary tools, one having a section movable to and from operative position, means for imparting a predetermined number of rotations to said tools, and means for automatically shifting said section during the first and last rotation of said predetermined number.

20. A machine for operating on sheet material, having in combination, a rotary tool having a plurality of recesses, a rotary tool having a corresponding number of intermeshing projections, one of said tools having a gap with parallel walls and a section guided for movement between said walls, and means for automatically shifting said section at predetermined points in selected rotations of said tool.

21. In a machine for operating on sheet material, a rotary tool having a plurality of projections arranged in rows oblique to its axis, a gap with walls parallel to said rows, and a section guided for movement between said walls into and out of said gap.

22. A machine for operating on strip material, comprising coacting rotary work feed-

ing tools arranged to grip and move along the work, one of said tools having a displaceable peripheral section, and means for moving said section to and from operative position to control the feeding movement of the strip to be operated upon.

23. A machine for operating on strip material, comprising rotary tools for feeding and perforating a strip of material, one having a displaceable section movable out of operative relation to the other roll, and automatic means for moving said section to and from operative position in specific predetermined rotations of the tool to control the extent of the strip which is perforated.

24. A machine for operating on sheet material, comprising a pair of rolls having intermeshing tool members, one of said rolls having a displaceable section, mechanism for automatically shifting said section to and from operative position in its roll, and provision for effecting a relative angular adjustment of the rolls without disturbing the action of said automatic shifting mechanism.

25. A machine for operating on sheet material, comprising a pair of rolls having intermeshing tool members, one of said rolls having an axially displaceable sector-like section with a circumferentially extending flange, and means acting on said flange to control the position of said section at all times in its roll.

26. A machine for operating on sheet material, comprising a roll having projecting tool elements and a cooperating roll having corresponding recesses, an elongated guide disposed on one side of the rolls and a gauge on the other side, said roll first mentioned having a section with tool elements which is axially displaceable and has a circular flange, starting and stopping mechanism for operating said rolls, mechanism operating in timed relation thereto and acting upon said circular flange to shift said section to permit the work to be inserted between the rolls and into contact with the gauge, and treadle mechanism for simultaneously withdrawing the gauge and tripping the starting and stopping mechanism.

27. A machine for operating progressively upon sheet material comprising a tool having a displaceable tool section, said tool being arranged to feed the work, means for displacing said section, a gauge located in the path of the work, and means for shifting said gauge to an inoperative position acting in timed relation to the movement of the displaceable tool section.

28. A machine for operating on sheet material having, in combination, a cylindrical member, and a tool comprising a plurality of sections the peripheral portions of which normally constitute a continuous cylindrical surface co-operating with the surface of said cylindrical member to act progressively upon

opposite sides of a work piece, said sections being mounted on the tool for movement relatively to each other axially of the tool to form a gap in the cylindrical surface of the tool to permit presentation of the work in position between the member and tool.

In testimony whereof I have signed my name to this specification.

MERTON D. PHELAN.