

Sept. 30, 1924.

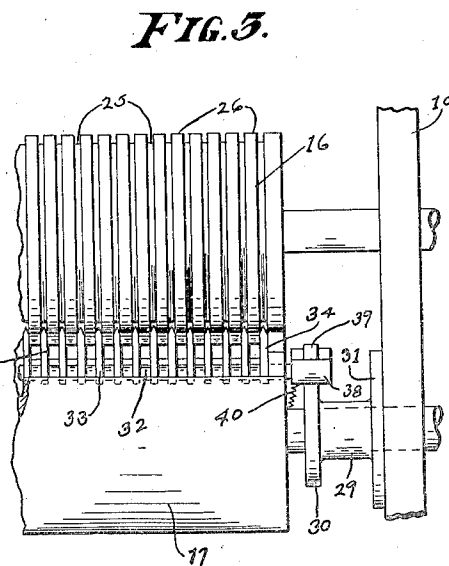
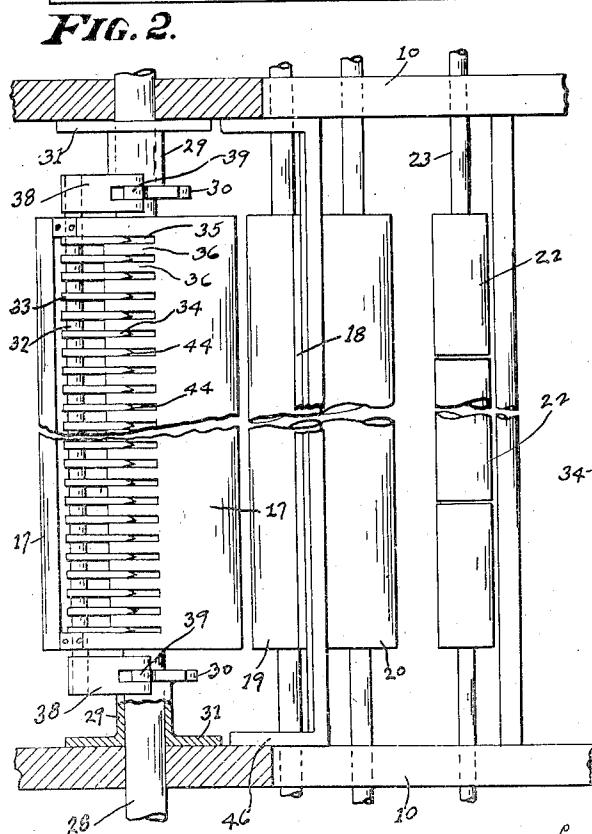
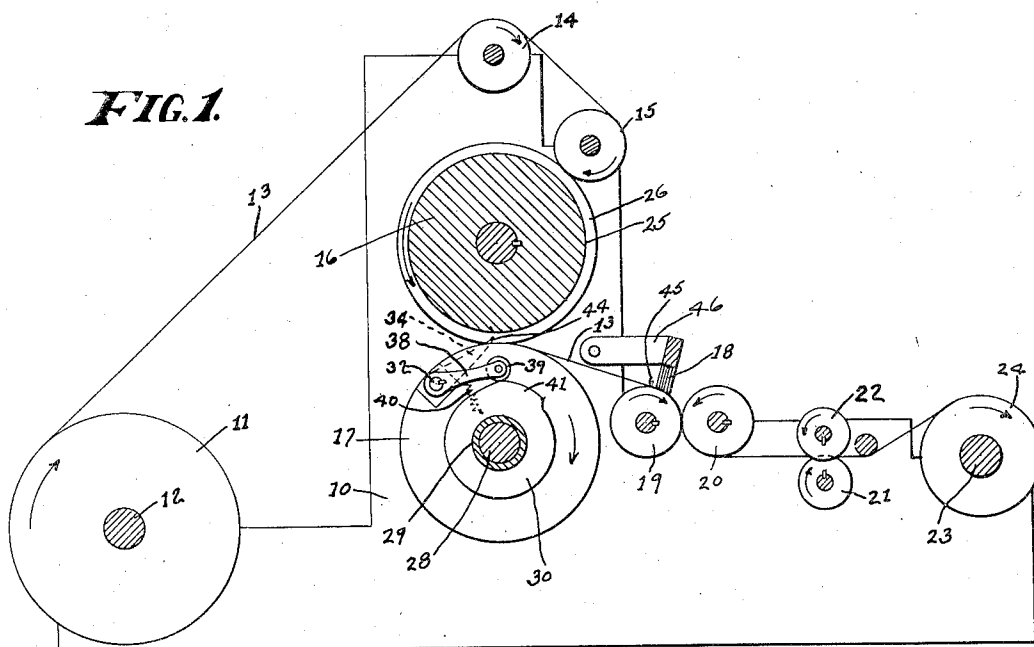
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PAPER PERFORATING MECHANISM

Filed July 26, 1922

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

FIG. 5.

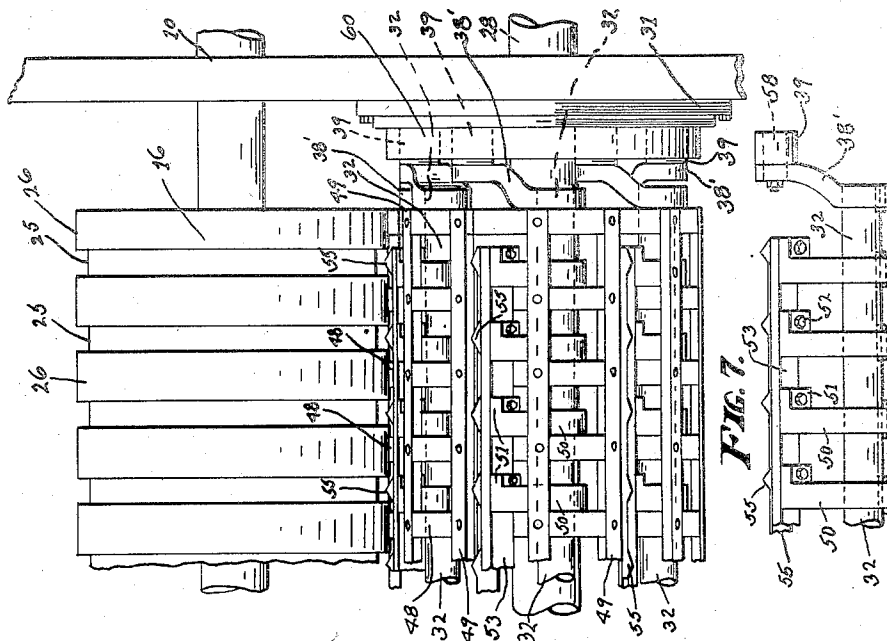


FIG. 7.

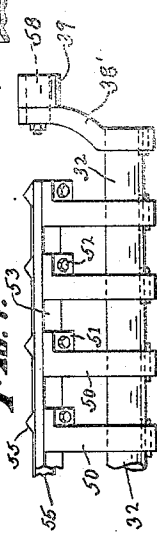


FIG. 4.

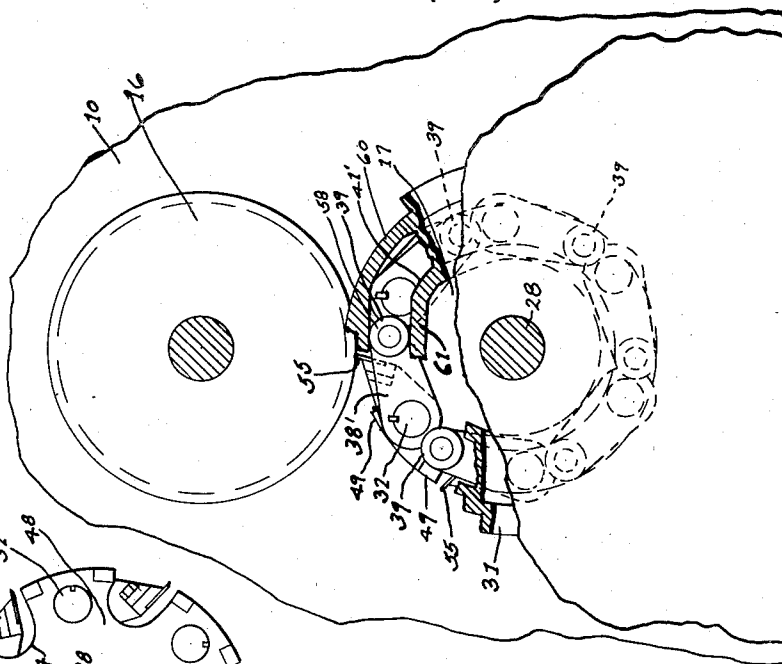
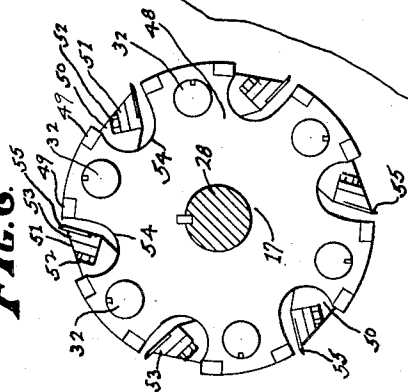


FIG. 6.



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PAPER-PERFORATING MECHANISM.

Application filed July 26, 1922. Serial No. 577,512.

To all whom it may concern:

Be it known that DAVID WILLIAM HUDSON, a citizen of the United States, residing at Green Bay, county of Brown, and State of Wisconsin, has invented new and useful Improvements in Paper-Perforating Mechanism, of which the following is a specification.

This invention relates to improvements in paper perforating mechanism of the type adapted to make a series of transverse perforations in a web of paper at regular intervals, whereby certain portions of the web are rendered detachable as separate sheets. The device is particularly adapted for use in connection with the manufacture of toilet paper, paper toweling and the like.

It is the object of this invention to provide novel and improved perforating mechanism capable of acting upon a continuously moving web of paper without tearing or mutilating the web otherwise than to form the desired perforations.

It is a further object of this invention to provide perforating mechanism adapted to act upon a web of paper to strike up triangular portions thereof in a series disposed transversely to the web, whereby adjacent portions of the web are more readily separable than is ordinarily the case where the usual perforating mechanism is employed.

It is a further object to provide, in combination with perforating mechanism adapted to strike up triangular portions of the sheet or web of paper passing therethrough, means for smoothing back and creasing the upwardly struck portions against the web to which they are attached, whereby they are rendered inconspicuous and permit of the web being wound smoothly into a roll for use.

Further objects of this invention are to provide a simplified device capable of continuous operation without attention other than such attention as is required to provide fresh rolls of paper to be acted upon and to remove the rolls of perforated paper; to provide a device which can be cheaply manufactured and readily assembled; and to provide a device acting upon the web of paper with a tearing action instead of a

cutting action, to the end that the perforating fingers need not be sharpened and can be used indefinitely without repair.

In the drawings:

Figure 1 is a diagrammatic side elevation of a device embodying this invention.

Figure 2 is a plan view of the lower portion of the device, the die roll being removed and the frame being shown in a horizontal section taken upon a plane lying between the die roll and the special roll which supports the perforating fingers.

Figure 3 is a detail view in end elevation of a portion of the die roll and the perforating mechanism.

Figure 4 is a fragmentary side elevation with portions of the machine frame and actuating mechanism broken away to expose details of a preferred embodiment of the device.

Figure 5 is a fragmentary end elevation of the preferred embodiment shown in Figure 4.

Figure 6 is a detail view of the end of the special roll which supports the perforating fingers in the preferred embodiment.

Figure 7 is a detail view of the mounting for the perforating fingers in the preferred embodiment.

Like parts are identified by the same reference characters throughout the several views.

In the embodiment illustrated in Figures 1, 2, and 3, I have illustrated only a single set of perforating fingers and have in other particulars rendered the showing diagrammatic in order to make clear in a general way the arrangement of the various parts of the mechanism. A machine frame indicated in its entirety at 10 supports a supply roll 11 rotatably mounted upon shaft 12 from which is led the web 13 to be acted upon by the perforating mechanism. The web passes about rolls 14 and 15 onto a die roll 16 and is acted upon by perforating mechanism carried by the roll 17. Thereafter it passes beneath a brush 18 and between creasing rolls 19 and 20. Thereafter a slitting roll 21, provided with peripheral knives in the usual manner and registering with a second die roll 22, cuts the web longitudinally into

strips of the desired width which are wound upon a mandrel 23 into rolls 24 of the completed product.

Having thus set forth the general arrangement of the parts, I will now discuss the several elements more particularly and explain their function.

The web 13 arrives at die rolls 16 under substantially constant tension due to the retarding action of rolls 14 and 15. The position of these latter rolls is such that the web passes around a large part of the periphery of the die roll 16 to the rolls 19 and 20 which are power driven and are in such juxtaposition as to crease the paper closely and maintain a constant tension upon web 13 and direct it closely about the periphery of die roll 16.

The die roll is preferably constructed as shown in Figure 3, with a series of conveniently spaced peripheral grooves 25 about its circumference, the grooves being separated by intervening ungrooved portions 26. The web 13 rests upon the latter with portions of its area disposed unsupported over the grooves 25.

The roll 17 which carries the perforating mechanism is mounted upon a shaft 28 which may be journaled in a sleeve 29 arranged to support the fixed disk cam 30 from the frame 10. The sleeve may be attached to the frame by means of a suitable annular flange 31. It is to be understood that sleeves 29 and cams 30 may be provided at each end of shaft 28. The roll 17, may if desired, be made solid and may be provided with a recess 32 longitudinally of the roll in its extreme surface. A rock shaft 33 is disposed in recess 32 parallel to the main shaft 28 which carries roll 17. Keyed to this shaft are a plurality of spaced fingers 34 adapted to be received, when elevated, into the peripheral grooves 25 of die roll 16. In their normal or concealed position the fingers 34 are received in the short grooves 35 disposed peripherally of roll 17 and communicating with the recess 32 therein. The ungrooved portions 36 of roll 17 which separate short grooves 35 are adapted to register with the ungrooved portions 26 of the die roll, whereby the web passing between rolls 16 and 17 may be engaged positively between the portions 26 of roll 16 and the portions 36 of roll 17 at the moment of perforation. It is not absolutely necessary to provide the ungrooved portions 36 in roll 17, and the recess 32 in said roll may be extended peripherally to receive entirely the fingers 34 and do away with grooves 35 and portions 36, if desired.

The rock shaft 33 is extended at either end of roll 17 and is provided at its ends with levers 38 rigidly connected to it and carrying rollers 39 disposed for travel upon the face of the disk cam 30. If desired, means

such as a tension spring 40 connected with the roll and with lever 38 may be utilized to hold said lever and the fingers 34 in a normally retracted position. When, however, the roller 39 reaches the nose 41 of cam 30 the lever 38 moves against the tension of spring 40 and rocks shaft 32 upon its axis, thereby elevating the perforating fingers 34 into the grooves 25 of die roll 16.

It will be understood from the foregoing that the cam 30 is fixed and that the actuation of lever 38 is accomplished during the bodily rotation of said lever about the axis of shaft 28. As viewed in Figure 1, the web of material to be acted upon by the perforating mechanism is traveling from left to right between rolls 16 and 17, and it will be obvious that the movement of the ends of fingers 34 induced by the roller 39 in the course of its travel about cam 30 will be such as to cause the tips of said fingers to enter the paper while moving in a direction reverse to the direction of paper travel.

As shown in Figures 2 and 3, each of the fingers 34 is provided with a tapering point 44 which may, if desired, be upwardly bent as shown in Figure 1. The point is prevented by spring 40 from entering the paper to any degree greater than that caused by the action of cam nose 41 upon cam roll 39. The effect of the entry of the several points into the web of paper in this manner will be to tear small triangular portions of the web away from the remainder thereof upon two sides. The portions so torn from the web are, of course, attached to the web at their bases. They will conform in size and shape to that portion of the perforating points which enters the web. The tendency of the web to become further torn will be limited, due to the support afforded to the web by the ungrooved portions of the die roll. Thus a transverse series of triangular openings are formed in the web simultaneously, and the triangular tongues 45 struck upwardly by the tips 44 of fingers 34 remain elevated as shown in Figure 1 until they are acted upon by the brush 18 which is supported by arm 46 in a fixed position closely adjacent to the periphery of pull-roll 19. The fingers 34 have in the meantime been retracted into grooves 35 by spring 40 following the descent of roller 39 from cam nose 41.

It is immaterial to this invention whether the brush 18 be solid or be provided with bristles. As the web is drawn between pull-rolls 19 and 20 the upwardly projecting tongue of paper 45 encounters the brush and is folded rearwardly. Immediately afterward the tongue is creased by the action of pull-rolls 19 and 20 so that thence-forward the tongue remains folded flat against the adjacent unbroken surface of the web. It will be understood, of course, that with the perforating mechanism in the position in

which it appears in Figure 1 the portion of the web last acted upon would have been advanced much farther than the position occupied by tongue 45, and the showing is purely diagrammatic and is intended only to indicate the upwardly projecting position of the tongue at the time it encounters the fixed brush 18.

The slitting rolls 21 and 22 are too well known in the art to require further explanation and they form no part of the present invention. It will be understood that the perforating mechanism can be mounted upon rolls 16 and 17 of such length as may be desired, and that the web passing over the perforating mechanism can be divided by the well known slitting rolls 21 and 22 into a plurality of narrower webs, each of which will have been perforated by the fingers carried by roll 17.

Having disclosed the arrangement and mode of operation of the independent elements of my improved perforating mechanism, I will now describe the embodiment of my invention which is preferred by me.

The principal change occurs in the perforating mechanism itself. Instead of being solid the roll 17 is preferably made of a series of spaced disks 48 which are keyed to shaft 28. The disks 48 are arranged to register with the ungrooved portions 26 of roll 16 and are secured in position by countersunk strips 49 disposed parallel to the axis of the roll. Journaled in said disks are the rock shafts 32, a plurality of such shafts being provided although only one was shown in Figure 1. Arms 50 carried by the rock shafts are provided at their ends with right angle flanges 51 and these flanges are apertured to receive bolts 52 threadedly engaged with bars 53. It will be noted in Figure 5 that one of the arms 50 is disposed between each pair of disks 48 upon each of the rock shafts 32, and all of the arms mounted upon a given rock shaft are connected by a bar 53 which is received in each case into a recess 54 in each of the disks 48. These recesses are best shown in Figure 6. In place of the separate fingers 34, shown in Figure 1, a saw-toothed blade 55 is used to effect the actual perforation of the web. The blades 55 are in each case carried by the longitudinally extending bar 53 and are normally concealed in the recess 54 of each of the disks 48, through which the bars pass.

At the end of each rock shaft 32 is keyed a lever 38' corresponding in function to the lever 38 in Figure 1. The lever 38', however, is provided with an outwardly projecting pin 58 upon which the cam roller 39 is mounted. In place of the disk cam 30 and spring 40, the preferred embodiment of my invention includes a double cam arrangement including a plate 60 provided with a cam groove 61 having its apex or nose at 41'.

The arrangement is such that as each roller 39 reaches the eccentric portion 41' of cam groove 60, the lever 38' will be moved in a way to actuate its attached rock shaft 32 counter-clockwise and thereby to elevate the several arms 50 mounted upon that rock shaft and the saw-toothed blade 55 supported therefrom. The construction of rock shafts 32, together with the arms 50 which each rock shaft carries and the manner in which the bars 53 and saw-toothed blades 55 are supported from said arms, is clearly indicated in Figure 7.

The remaining portions of the two machines are identical. The chief difference between them lies in the fact that in the preferred embodiment of my invention the roll 17 instead of being solid is a skeleton roll made up of the disks 48 secured together by bars 49 and by being keyed to a common shaft 28. These disks provide bearings at intervals for the rock shafts 32 and are recessed at a plurality of points in order to enable the perforating teeth of blade 55 to be received normally within the contour of the roll.

It will be understood that the action of the several teeth of blade 55 corresponds exactly to the action above described of the fingers 34, disclosed in Figures 1 to 3 inclusive. The action of the cam groove 61 upon the several rollers 39, however, in the preferred embodiment is more positive as to the retraction of the perforating teeth than is the action of the spring 40 shown in Figures 1 and 3.

While the device disclosed in Figures 1 to 3 is an operative structure, it will be understood that only one perforation would be made for each rotation of roll 17. In the device shown in Figures 4 to 7 inclusive, six sets of transverse perforations will be made for each rotation of roll 17 and the construction of the roll is materially simplified. Such a roll as is disclosed in the preferred embodiment of my invention is comparatively easy to construct and is relatively light in weight.

During the operation of either embodiment of my invention, the web of material will be passed between rolls 16 and 17 in the manner above described. In each case the paper will be engaged and firmly held between said rolls at the time when roller 39 is actuated by the cam to lift the perforating fingers 34 or the blade 55 which has correspondingly shaped teeth. In each case the fingers or perforating teeth are moving reversely to the direction of travel of the web at the moment of entry, and in each case a triangular tongue is struck upwardly by each finger from the web. The tongues so struck up project slightly forwardly when released by the retraction of the perforating fingers and are turned back against the face

of the web by the action of brush 18 and are creased in that position by rolls 19 and 20.

The web thus having been divided into 5 separable sheets may be slit longitudinally into a number of strips and is wound upon roll 24. Where the web is passed through the device shown in Figure 1 the perforations will be comparatively far apart and 10 the sheets separable from the web will accordingly be comparatively long. Where, however, the web is passed through the preferred embodiment of my invention the compact disposition of the perforating 15 blades 55 about the periphery of roll 17 will result in the formation of a series of sets of perforations which are relatively close together, whereby relatively smaller sheets will be separable from the web. Obviously 20 by altering the size of roll 17 or the spacing of rock shafts 32 about the periphery of said roll, the size of sheets separable from the web can be entirely controlled.

It is commonly recognized that a web of 25 paper must be supported during a perforating operation, but it has heretofore been the general practice to provide a transverse groove to receive a transverse series of perforating points. This practice is objection- 30 able, for the reason that the points tend to force the entire web of paper into a transverse groove without perforating it. This will occur unless the die roll and the roll 35 carrying the perforating points are exactly synchronized so that the points may act upon the web with a shearing action across one margin of the transverse groove of the die roll. The web must also be kept under 40 proper tension, since any slack will permit the paper to pass without being perforated.

In the device herein disclosed no syn- 45 chronism of the die roll with the roll carrying perforating points is necessary since each point of the transverse series registers with an annular groove of the die roll and may enter into any peripheral portion of 50 such groove. It is likewise impossible for the paper to pass through this machine without becoming perforated, inasmuch as the ungrooved portions of the die roll support 55 the paper at a plurality of transverse points and therefore do not permit the paper to become folded about the perforating elements in the manner which would be possible if such elements co-operated with a transverse groove in the die roll.

From the foregoing it will be understood 60 that the co-operation of a transversely extending series of perforating points with a peripherally or annularly grooved die roll is extremely important to the operation of this machine, not only for the reason that 65 the ungrooved portions of the die roll limit the tearing action of the points on the pa-

per, but for the further and more impor- 65 tant reason that the action of the machine is entirely positive and requires absolutely no synchronism whatsoever between the die roll and the roll which carries the perforating elements. It will be understood that 70 in referring to peripheral grooves herein, I mean grooves which extend annularly about the periphery of the die roll.

I claim:

1. The combination with a grooved die and 75 means for moving a web past the die said die being grooved in the direction of web travel, of a set of perforating elements reg- 80 istering with the grooves of the die, said elements extending transversely with refer- 85 ence to the path of web movement and being maintained normally in a retracted po- sition, and means for projecting said ele- 90 ments in the direction of the die and through the web with a motion having a longitudi- 95 nal component with reference to the web, whereby tongues are struck upwardly from said web conforming in shape to the pene- 100 trating ends of said perforating elements.

2. The combination with means for ad- 105 vancing a web of paper, of a die for the support of said paper grooved in the direc- 110 tion of web advance, a set of perforating elements associated with a series extending 115 transversely with respect to the direction of web advance, means supporting said ele- 120 ments for oscillation into and out of the grooves of said die, said elements being 125 spaced for registry with said grooves and means for actuating said supporting means to control the oscillation thereof and adapted to produce periodical movement of said elements into said grooves, the ungrooved 130 portions of said die being adapted to support a web during the perforation thereof and to limit the action on said web of said perforating elements.

3. In a device of the character described, the combination with means for continuously 135 advancing a web of paper, of a periph- 140 erally grooved rotatable die arranged to co-operate and support said paper, a roll co- operable with said die, a plurality of trans- 145 versely extending sets of pointed perforat- 150 ing elements, said elements being arranged for registry with the grooves of said die, means for supporting said elements and 155 means for periodically projecting said elements in the direction of said die whereby to perforate a web of material supported 160 from the die, the portion of said die intermediate the grooves thereof being adapted to limit the tearing of a web acted upon by said elements without requiring any syn- 165 chronism of rotation between said die and said roll.

4. The combination with a peripherally 170 grooved die roll and means for passing a

web of material around said roll, of a set of perforating elements, and means for projecting said elements periodically into said web in a direction having a component tangential to said die roll and opposite to the direction of travel of the web thereon.

5 The combination with a peripherally grooved die roll, of a plurality of perforating elements, means for supporting said elements in a normally retracted position and in registry with the grooves of the die roll, and means for periodically projecting said elements into said grooves with a movement having a directional component tangential to the die roll and opposite to the direction of travel of the web thereon.

6. The combination with a die roll provided with peripheral grooves and cylindrical surfaces between said grooves, of a rotatable member provided with cylindrical surfaces adapted to register and co-operate with the corresponding surfaces of the die roll, perforating elements in a transverse series carried by said member in a normally retracted position, and means for projecting said elements outwardly from said member into the grooves of the die roll.

7. In a device of the character described, the combination with a rotatable die roll provided with peripheral grooves and supporting surfaces intermediate said grooves, of means for feeding a web of perforable material continuously across said roll, a co-operating rotatable member, a set of pointed perforating elements extending in an axial direction with respect to said member, said elements being spaced for registry with the grooves of said die roll, levers normally disposed upon a chord of said rotatable member and adapted normally to support said perforating elements in a retracted position, and means for oscillating said members to project said perforating elements beyond the periphery of said member and into the grooves of said die roll, said elements being so disposed that upon the oscillation of said lever they will present their side surface to the web with their points slightly in advance, whereby to operate with a tearing action to sever tongues from said web.

8. Perforating mechanism including a die, a rotatable member arranged for co-operation therewith, a lever pivoted at one end to said member and normally disposed upon a chord thereof, a pointed perforating element at the end of the lever, and means for projecting said pointed element outwardly about the pivot point of said lever when said element reaches the die.

9. Perforating mechanism including a rotatable member of cylindrical contour, a lever pivotally mounted within a recess in said member and normally disposed on a

chord thereof, a perforating point at the free end of said lever, and means for oscillating said lever about its pivot at a predetermined point in the rotation of said member.

10. Perforating mechanism including the combination with a peripherally grooved die roll, of a rotatably mounted skeleton roll comprising a plurality of recessed disks mounted upon a common axis and spaced to co-operate with ungrooved portions of the die roll, a rock shaft carried in said disks, levers between said disks normally disposed upon chords thereof and mounted for oscillation upon said rock shaft, perforating points at the free ends of said levers, and means including a cam for effecting the oscillation of said rock shaft at a predetermined point in the rotation of said skeleton roll.

11. The combination with means for striking up triangular tongues in a web of material, of means for folding said tongues back against the web, and means for subsequently creasing the tongues as folded.

12. The combination with means for supporting a web of paper and means for striking up a transverse series of tongues therefrom, of means for acting upon said tongues to bend them against the adjacent unperforated portion of the web, and means for creasing said tongues at their bent portions.

13. The combination with means for continuously moving a web of material, of means for striking up tongues from the moving web, and means disposed in the path of said tongues for bending them rearwardly.

14. The combination with means for supporting and continuously moving a web of material, of means for forming a transverse series of spaced tongues therein, a brush disposed in the path of said tongues and adapted to bend them rearwardly, and means for creasing the bend between said tongues and the web.

15. A set of rotatable rolls adapted to engage a web of paper and move it forwardly, means for striking up tongues from a web prior to its entry between said rolls, and a brush disposed in the path of said tongues and adapted to fold them rearwardly, said rolls being adapted to crease the fold between the tongues and the web.

16. The combination with means for advancing a web, and a die grooved in the direction of web travel for supporting a web of material, of perforating mechanism including a perforating element having sides converging to a point and pivoted at a part remote from its point, and means for actuating said element about said pivot into contact with a web supported from said die, the point of said element being the first portion

thereof to encounter said web, whereby a tongue is partially severed therefrom.

17. The combination with means for supporting a web of material, of perforating
5 mechanism including a perforating element having sides converging to a point and pivoted at a part remote from its point, means for actuating said element about said pivot
10 into contact with a web supported upon said supporting means, the point of said element being the first portion thereof to encounter said web, whereby a tongue is partially sev-

ered therefrom, and means for folding back and creasing said tongue against the adjacent unperforated portion of the web.

18. The combination with a peripherally
15 grooved die roll for supporting a continuously moving web of material, of a set of perforating points, and means for periodically projecting said points through the
20 moving web in a direction having a longitudinal component relative to the web and opposite to web movement.

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