

June 7, 1960

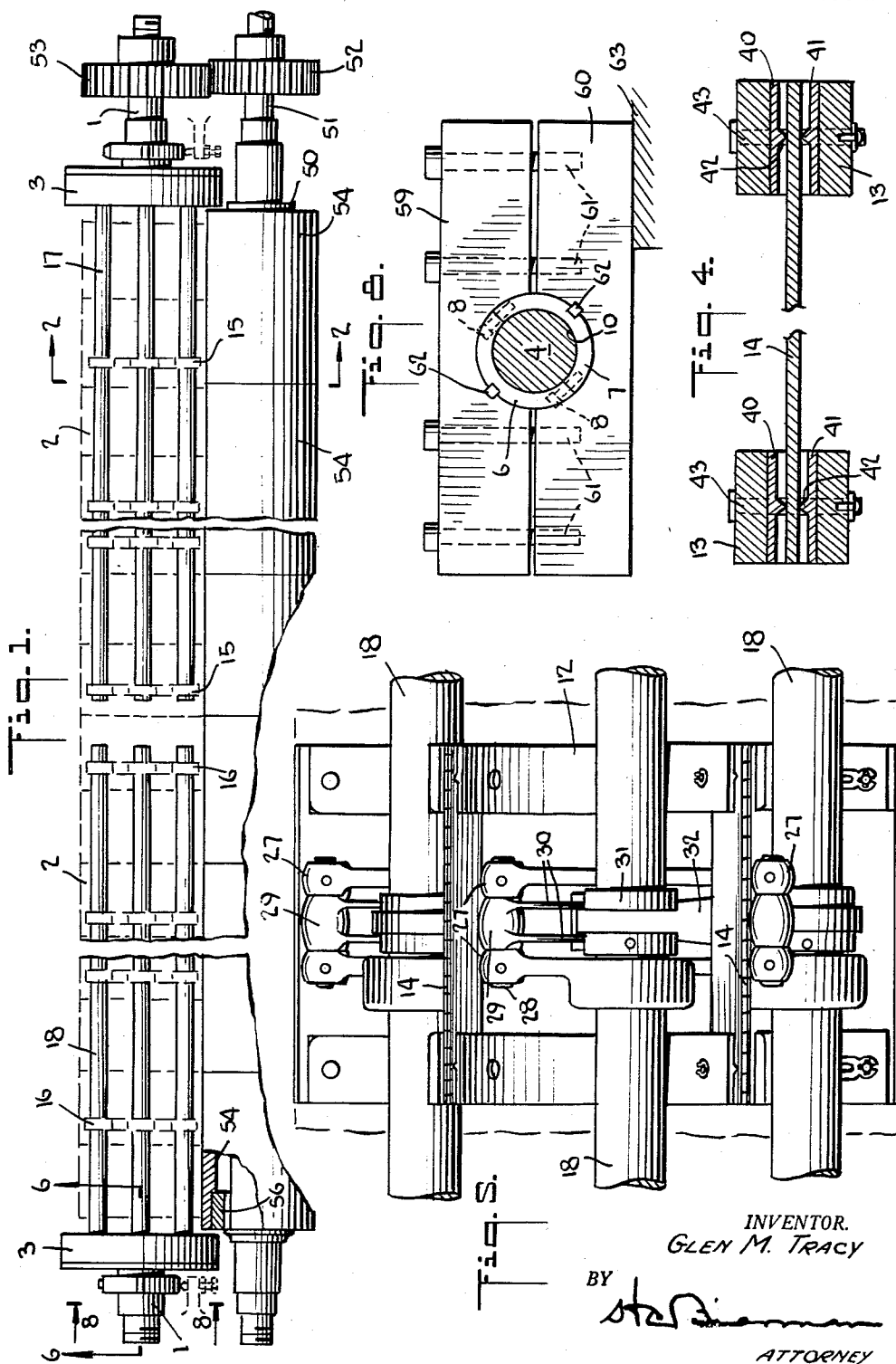
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2,939,356

APPARATUS FOR PERFORATING SHEETS

Filed April 20, 1956

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

Fig. 2.

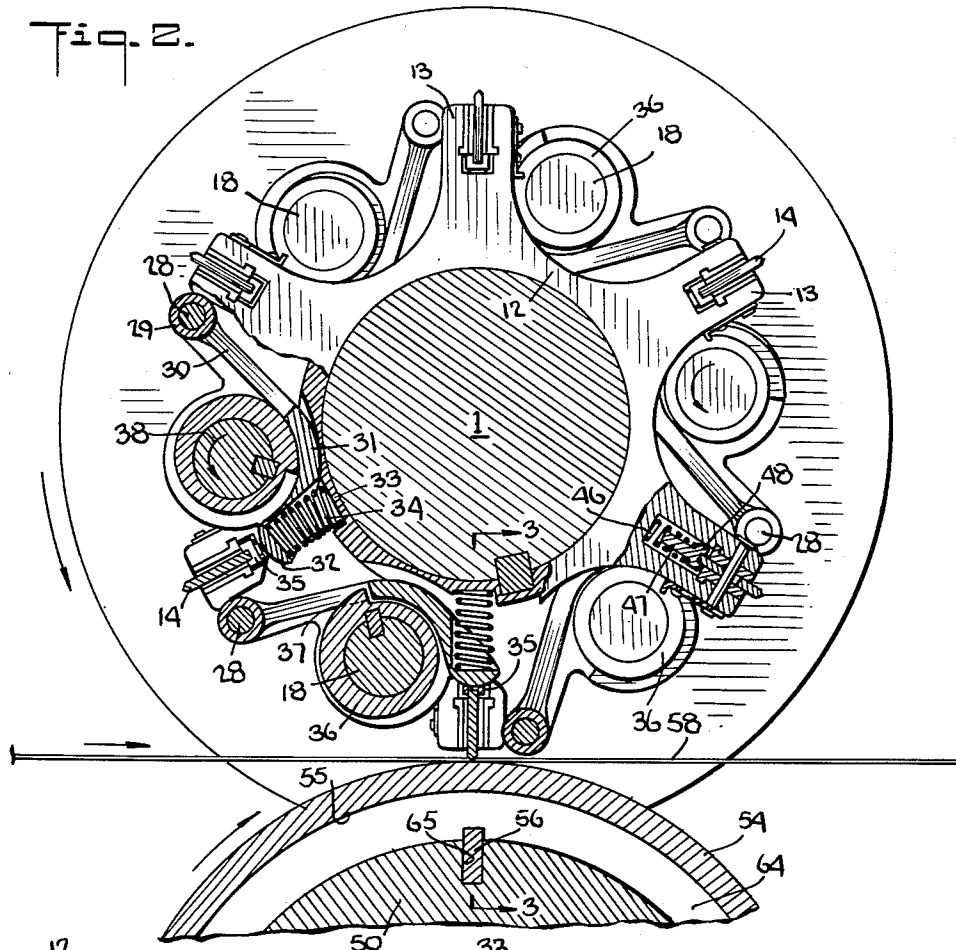
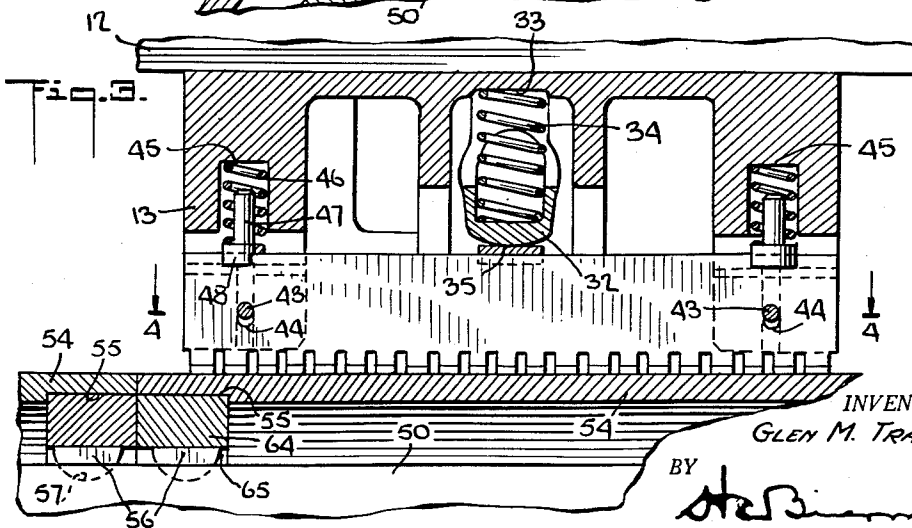


Fig. 3.



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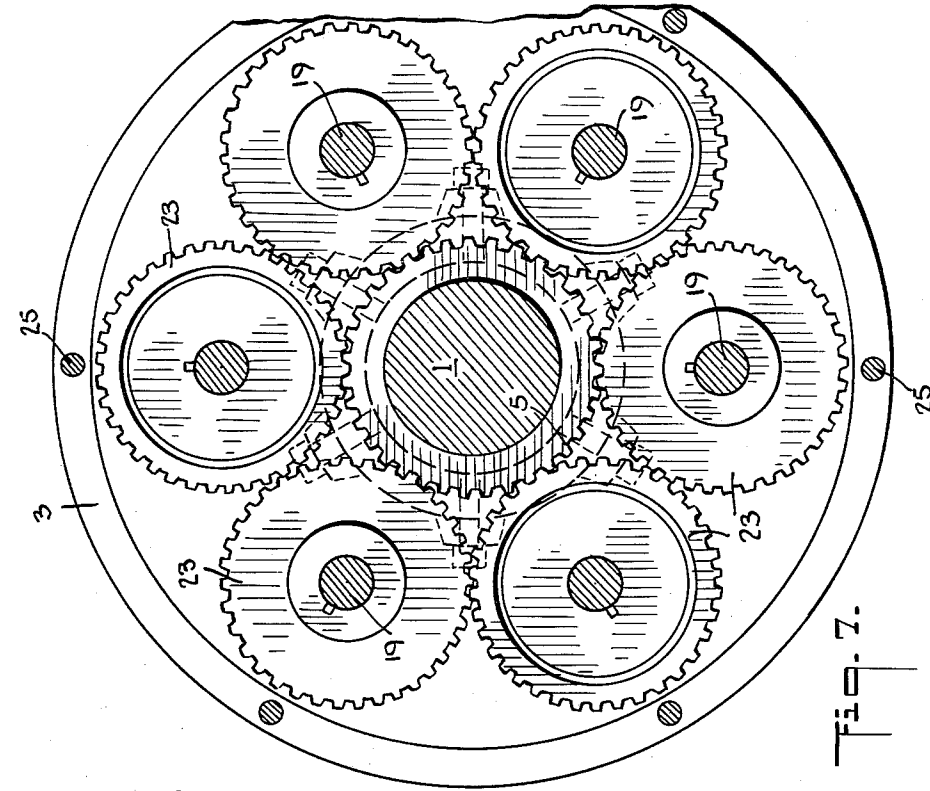
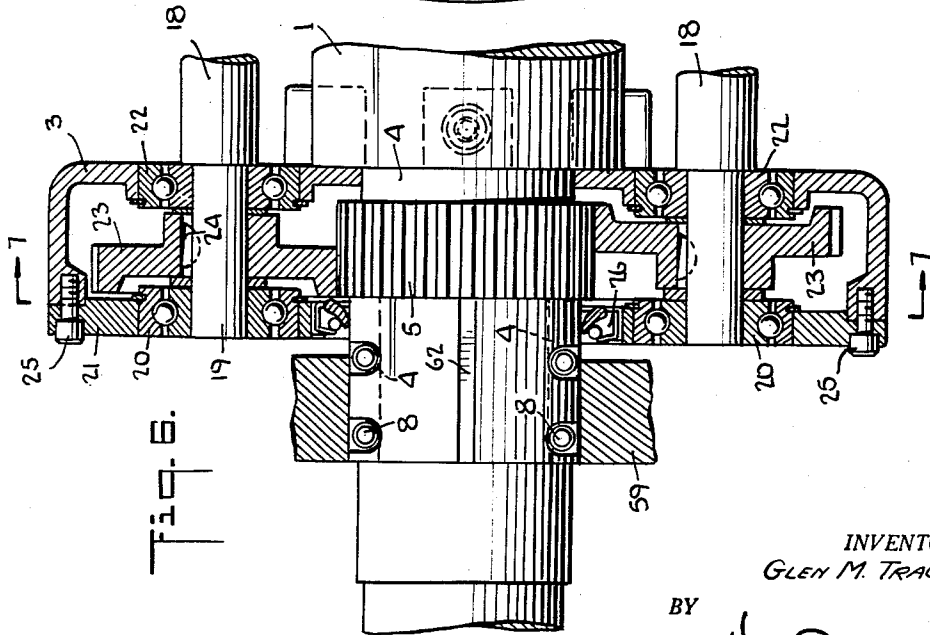
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APPARATUS FOR PERFORATING SHEETS

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3 Sheets-Sheet 3



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2,939,356

APPARATUS FOR PERFORATING SHEETS

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10 Claims. (Cl. 83—337)

The present invention is directed to an apparatus for perforating sheets of various materials, such as toilet tissues, and is directed to a device which is capable of continuous and high speed operation.

In co-pending application Serial No. 551,269, filed December 6, 1955, entitled "Method and Apparatus for Cutting Tissues and the Like," and now abandoned, there is described a new principle of operation, wherein the amount of pressure necessary for cutting is reduced very substantially. In accordance therewith, there is provided a lower surface over which a sheet to be transversely cut is passed. Said surface acts as an anvil having a relatively hard surface. The sheet is passed over and in contact with said surface and a transverse knife or cutting edge carried by an upper member is placed momentarily in contact with the sheet at the line of contact of the sheet with the hard surface with a preloading pressure sufficient to compress the fibers. At practically the same moment, the base of the knife is tapped, thereby cutting through the sheet, giving an instantaneous shock to drive the knife through the fibers.

The energy of impact drives the cutting edge through the paper, thus giving a clean cut with smooth edges. The cutting effect spreads the fibers of the sheet slightly and usually forms a very narrow slot. It has a neat appearance and there are no ragged edges. The action is rapid even at the high speed of feeding of the sheet and even though a wide sheet is cut along its entire width, the cuts are practically perfect.

The present invention utilizes the principles set forth in the pending application and is intended and adapted to incorporate said principles in an operative machine, it being among the objects of the present invention to provide an apparatus of the character described, which is adapted for high speed operation and also for use on relatively wide sheets of material.

It is also among the objects of the present invention to provide a mechanism which may be readily assembled, which is highly effective in operation and in which it is a simple matter to replace broken, damaged or worn out parts.

It is further among the objects of the present invention to provide an apparatus which requires but a small amount of energy for the cutting operation and in which wear due to high speed operation is minimized.

The invention is intended to operate on relatively wide sheets of material to make a series of alined slits or cuts transversely of said sheets. To accomplish this an alined set of knives is provided, and a plurality of such sets is incorporated in the apparatus, so that high speed operation with large production is assured.

In practicing the present invention there is provided a pair of rolls which are relatively long, one of the rolls being a perforating roll and the other being a bed roll, with means for rotating said rolls in unison. The perforating roll consists essentially of a shaft on which there are mounted a number of body members or spiders,

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which are in substantial contact end to end. Each of the body members carries a plurality of longitudinal countershafts, the latter carrying planet gears at their ends, meshing with a sun gear suitably mounted on the perforated roll. Cams are mounted on the countershafts and are in cooperative relation to cam followers mounted on said bodies. The followers terminate in hammers which are adapted to tap knives mounted in said bodies, said tapping being at the proper moment for cutting through the sheet material.

The bed roll is mounted usually below the perforating roll and consists essentially of a shaft with a plurality of cylindrical sleeves mounted thereon in end to end contact. The sleeves are keyed to the shaft. The inner diameter of the sleeves is greater than the outer diameter of the bed roll shaft so as to provide a rigid base or anvil to absorb the energy of the knives as they are tapped by the hammers.

In the accompanying drawings constituting a part hereof and in which like reference characters indicate like parts,

Fig. 1 is a front elevational view of an apparatus for perforating sheets made in accordance with the present invention;

Fig. 2 is a transverse cross-sectional view thereof taken along line 2—2 of Fig. 1;

Fig. 3 is a fragmentary cross-sectional view on an enlarged scale, showing the details of construction and mounting of the knives;

Fig. 4 is a transverse cross-sectional view taken along line 4—4 of Fig. 3;

Fig. 5 is a fragmentary enlarged front elevational view of a central portion of the perforated roll, showing the mounting of cams and followers thereon;

Fig. 6 is a transverse cross-sectional view taken along line 6—6 of Fig. 1;

Fig. 7 is a cross-sectional view taken along line 7—7 of Fig. 6, and

Fig. 8 is an end view taken along line 8—8 of Fig. 1.

On main shaft 1 is mounted the perforating roll consisting of a series of body members or spiders 2 in end to end contact. A planetary gear system is held in casing 3 at either end of the perforating roll. The end of shaft 1 is reduced, as shown at 4, and a sun gear 5 is mounted on said reduced portion. The sun gear is split along a diameter and has extensions 6 and 7 thereon. Said extensions are held together by bolts 8. Said extensions constitute a bearing 10 as shown more particularly in Fig. 8, and permit free rotation of shaft 1 while sun gear 5 is held stationary.

A split sun gear lock consists of a pair of blocks 59 and 60 held together by screws 61 and surrounding extensions 6 and 7. Said lock is secured to said extension by keys 62. The sun gear is held stationary by lock 59—60 abutting against anchor 63.

Each of the spiders has a central body portion 12 and a series of radial forked extensions 13 within which knives 14 are mounted for radial movement. There are two sets of holders 15 and 16 on said spiders for mounting countershafts 17 and 18. As shown in Fig. 1, countershafts 17 extend into casing 3 at the right and countershafts 18 extend into casing 3 at the left. As shown more particularly in Fig. 6, the ends of countershafts 17 and 18 are reduced as shown at 19 and are fitted with bearings 20 held in cover plate 21. Bearings 22 are held in casing 3 and planet gears 23 are keyed at 24 to shaft 19. Said planet gears mesh with sun gear 5. Cover 21 is held in oil-tight contact with casing 3 by bolts 25. A standard oil seal 26 is provided.

In bosses 27 constituting a part of body element 2 is rotatably held pin or pivot 28, on which is mounted the

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hub 29 of a cam-follower. A forked extension 30 terminates in follower 31, which in turn terminates in hammer 32. A coil spring under compression 34 is mounted between head 32 and recess 33 in central body 12. Hammer 32 is adapted to contact with or tap hardened metal member 35 mounted on the back of knife 14. A cam 36 having a high portion 37 is mounted on countershaft 18 and is suitably keyed thereto. It is adapted to rotate in the direction of arrow 38.

Each knife is held in position within a pair of forks 13 by plates 40 and 41 on opposite sides of the knife, and having knife edges 42. Pins 43, passing through forks 13 also pass through elongated slots 44 in the body of the knife, allowing limited radial movement thereof. In recesses 45 are preloading springs 46 in the form of coils. Stems 47 of block 48 fit within springs 46 which exert preloading pressure on said blocks which embrace the backs of knives 14.

The bed roll consists of a shaft 50 having a reduced end 51 on which gear 52 is mounted. It meshes with gear 53 on shaft 1 and a source of power is connected to one of these shafts. A series of relatively thin walled cylindrical sleeves 54 are mounted on shaft 50 in end to end contact. At the under side of each of the sleeves at the opposite ends thereof are recesses 55 into which are tightly fitted end rings 64 which contact shaft 50. Keyways 65 receive the flat ends of Woodruff keys 56 held in keyways 57 in shaft 50.

In the operation of the apparatus, a sheet of material 58, as shown in Fig. 2, passes between the perforating and bed rolls as they rotate in unison. During such rotation, each of the cams 36 moving in the direction of arrow 38 gradually raises hammer 32 until it is at its maximum height relative to knife 14. Then as the knife comes in contact with sheet 58, the high point 37 of the cam passes to the left of follower 31, thereby releasing it and causing hammer 32 to tap head 35 of knife 14. This occurs so rapidly that a clean cut or slit is made in the sheet 58 without ragged edges. While the amount of energy imparted to the knife is only a few pounds, it is sufficient to cut cleanly through the sheet. The movement of the knife causes it to contact sleeve 54 but since said sleeve is mounted in a rigid manner, the energy imparted thereto is extremely small so that the wear on the sleeve is negligible.

As the rolls continue their rotation, the cams, followers and knives come successively into the position shown at the lower portion of Fig. 2 to exert the cutting or their perforating action. The operation may be conducted at high speed with clean and perfect cutting or slitting. If in time there is some wear to some of the elements, they are so arranged as to be readily replaceable. For instance, a knife may be readily replaced by removing pins 43, pulling out the knife, replacing it with another one and reinserting pins 43. Similarly a cam 36 or a follower 31 may be readily replaced. In the bed roll each of the sleeves 54, if worn or broken, may be replaced by sliding such sleeves off of one end of shaft 50 and replacing it with a new sleeve.

I claim:

1. In a mechanism for transversely perforating sheets of paper and the like, a perforating roll comprising an elongated body, a central shaft on which said body is mounted for rotation, two sets of countershafts arranged end to end, each set having a plurality of countershafts parallel to said central shaft and mounted on said body, a sun gear mounted on said central shaft at each end thereof, planet gears on the outer end of each set of said countershafts and meshing with said sun gear, radially reciprocable knives on said body, and means on said countershafts for periodically reciprocating said knives.

2. In a mechanism for transversely perforating sheets of paper and the like, a perforating roll comprising an elongated body, a central shaft on which said body is

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mounted for rotation, a plurality of countershafts parallel to said central shaft and mounted on said body, a sun gear mounted on said central shaft at one end thereof, planet gears on the end of said countershafts and meshing with said sun gear, radially reciprocable knives on said body, and means on said countershafts for periodically reciprocating said knives, said body having a central portion, a plurality of radial extensions thereon, said knives being mounted in said extensions.

3. In a mechanism for transversely perforating sheets of paper and the like, a perforating roll comprising an elongated body, a central shaft on which said body is mounted for rotation, a plurality of countershafts parallel to said central shaft and mounted on said body, a sun gear mounted on said central shaft at one end thereof, planet gears on the end of said countershafts and meshing with said sun gear, radially reciprocable knives on said body, and means on said countershafts for periodically reciprocating said knives, said body having a central portion, a plurality of radial extensions thereon, said knives being mounted in said extensions, a plurality of cam followers pivoted on said extensions adjacent to said knives, the free ends of said followers being adapted to contact the backs of said knives.

4. In a mechanism for transversely perforating sheets of paper and the like, a perforating roll comprising an elongated body, a central shaft on which said body is mounted for rotation, a plurality of countershafts parallel to said central shaft and mounted on said body, a sun gear mounted on said central shaft at one end thereof, planet gears on the end of said countershafts and meshing with said sun gear, radially reciprocable knives on said body, and means on said countershafts for periodically reciprocating said knives, said body having a central portion, a plurality of radial extension thereon, said knives being mounted in said extensions, a plurality of cam followers pivoted on said extensions adjacent to said knives, the free ends of said followers being adapted to contact the backs of said knives, said free ends constituting hammers, the connection between said hammers and the pivots of said followers having a central elongated opening adapted to allow the entrance of the high portion of said cams.

5. In a mechanism for transversely perforating sheets of paper and the like, a perforating roll comprising an elongated body, a central shaft on which said body is mounted for rotation, a plurality of countershafts parallel to said central shaft and mounted on said body, a sun gear mounted on said central shaft at one end thereof, planet gears on the end of said countershafts and meshing with said sun gear, radially reciprocable knives on said body, and means on said countershafts for periodically reciprocating said knives, said sun gear being split along its diameter, a lateral extension on said sun gear, and means for anchoring said extension against rotation.

6. In a mechanism for transversely perforating sheets of paper and the like, a perforating roll comprising an elongated body, a central shaft on which said body is mounted for rotation, a plurality of countershafts parallel to said central shaft and mounted on said body, a sun gear mounted on said central shaft at one end thereof, planet gears on the end of said countershafts and meshing with said sun gear, radially reciprocable knives on said body, and means on said countershafts for periodically reciprocating said knives, said body having a central portion, a plurality of radial extensions thereon, said knives being mounted in said extensions, a plurality of cam followers pivoted on said extensions, the free ends of said followers constituting hammers, heads on the backs of said knives, said hammers being adapted to contact said heads.

7. A mechanism for transversely perforating sheets of paper and the like comprising a bed roll mounted for rotation, means for passing said sheet over and in contact with said bed roll, a perforating roll mounted for rotation,

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a plurality of cutting edges mounted in said perforating roll for limited radial movement, means for biasing said cutting edges toward said bed roll, hammers for said cutting edges adapted to contact the backs of said cutting edges, hammer arms mounted on said perforating roll for limited arcuate movement to actuate said hammers, means for moving said arms at predetermined intervals, and means for imparting potential energy to said hammers when they are in retracted position.

8. A mechanism for transversely perforating sheets of paper and the like comprising a bed roll mounted for rotation, means for passing said sheet over and in contact with said bed roll, a perforating roll mounted for rotation, a plurality of cutting edges mounted in said perforating roll for limited radial movement, means for biasing said cutting edges toward said bed roll, hammers for said cutting edges adapted to contact the backs of said cutting edges, hammer arms mounted on said perforating roll for limited arcuate movement to actuate said hammers, means for moving said arms at predetermined intervals, and spring means for imparting potential energy to said hammers when they are in retracted position.

9. A mechanism for transversely perforating sheets of paper and the like comprising a bed roll mounted for rotation, means for passing said sheet over and in contact with said bed roll, a perforating roll mounted for rotation, a plurality of cutting edges mounted in said perforating roll for limited radial movement, a pair of spaced springs in said perforating roll for biasing each of said cutting edges toward said bed roll, hammers for said cutting edges adapted to contact the backs of said cutting edges, hammer arms mounted on said perforating roll for limited arcuate movement to actuate said hammers, means for moving said arms at predetermined intervals,

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and means for imparting potential energy to said hammers when they are in retracted position.

10. A mechanism for transversely perforating sheets of paper and the like comprising a bed roll mounted for rotation, means for passing said sheet over and in contact with said bed roll, a perforating roll mounted for rotation, a plurality of cutting edges mounted in said perforating roll for limited radial movement, a pair of spaced springs in said perforating roll for biasing each of said cutting edges toward said bed roll, hammers for said cutting edges adapted to contact the backs of said cutting edges, hammer arms mounted on said perforating roll for limited arcuate movement to actuate said hammers, means for moving said arms at predetermined intervals, and means for imparting potential energy to said hammers when they are in retracted position, said hammers contacting the backs of said cutting edges at points intermediate said pairs of springs.

References Cited in the file of this patent

UNITED STATES PATENTS

	465,604	Tucker	Dec. 22, 1891
25	1,306,009	Hartman	June 10, 1919
	1,690,410	Hudson	Nov. 6, 1928
	1,726,611	Cook	Sept. 3, 1929
	1,802,554	Hahn	Apr. 28, 1931
	2,018,366	Klaue	Oct. 22, 1935
30	2,186,679	Lade	Jan. 9, 1940
	2,704,577	Haldeman	Mar. 22, 1955
	2,757,442	Allen	Aug. 7, 1956
	2,797,754	Bornmann	July 2, 1957
	2,850,093	D'Angelo et al.	Sept. 2, 1958