

[54] ROTATABLE RESILIENT PUNCH AND DIE CUTTER APPARATUS

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[57] ABSTRACT

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[51] Int. Cl..... B26f 1/08

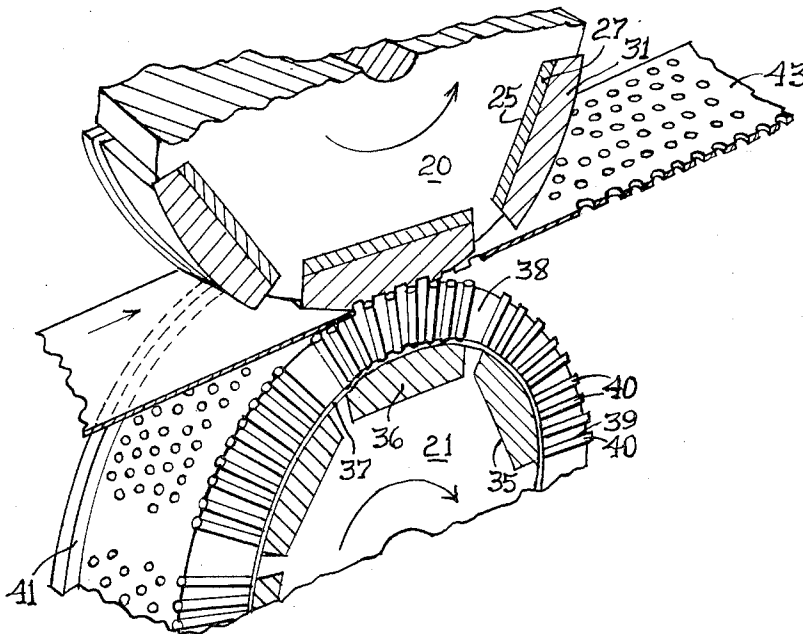
[58] Field of Search 83/117, 345, 542, 670

A perforating, cutting, or embossing apparatus consisting of a pair of coating rotatable rollers, one of which has mounted on its periphery a urethane punch, while the other roller provides an anvil in the form of a metallic die plate designed to cooperate with the punch to perform the desired operating function.

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8 Claims, 4 Drawing Figures



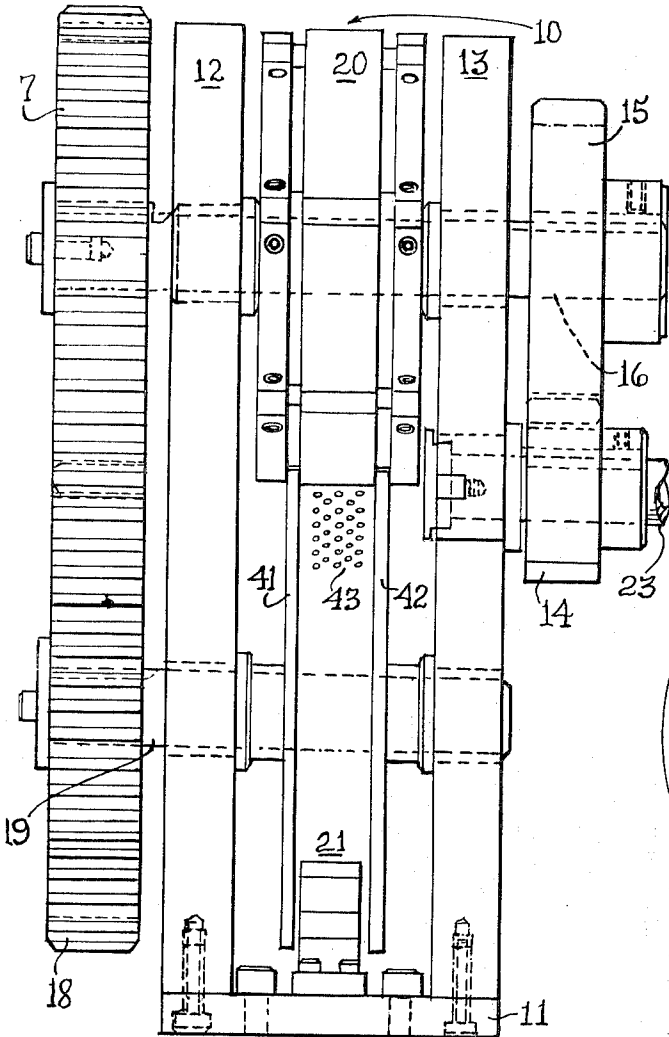


Fig. 1.

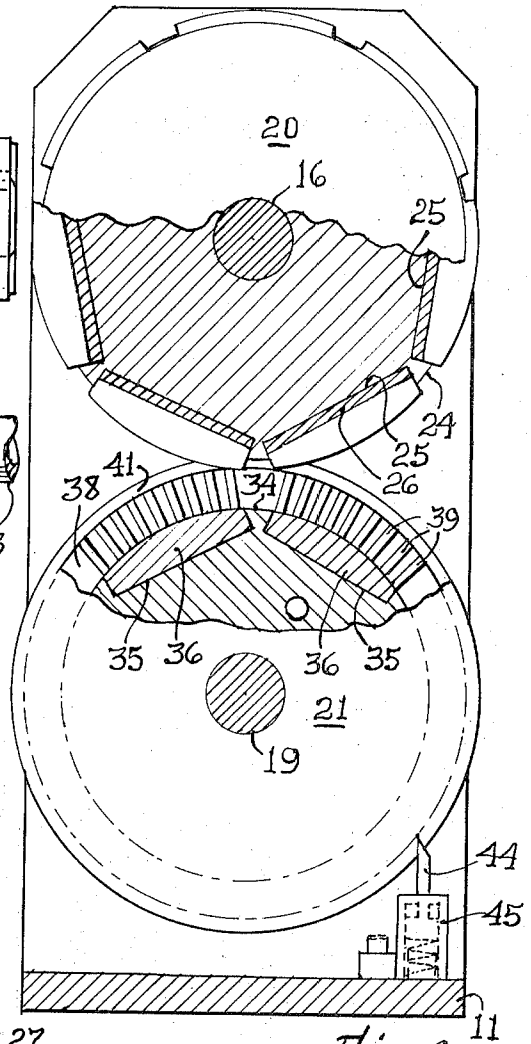


Fig. 2.

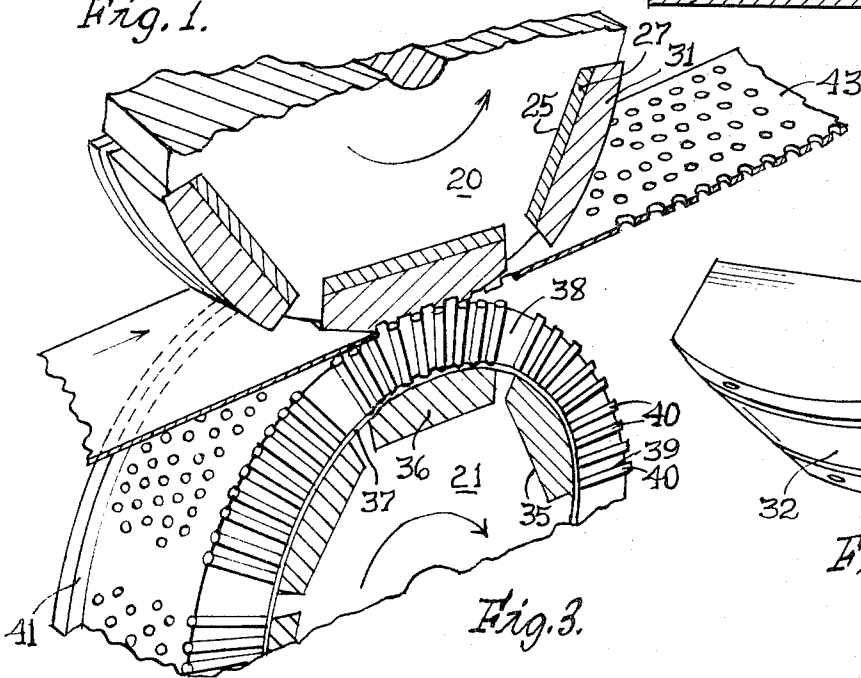


Fig. 3.

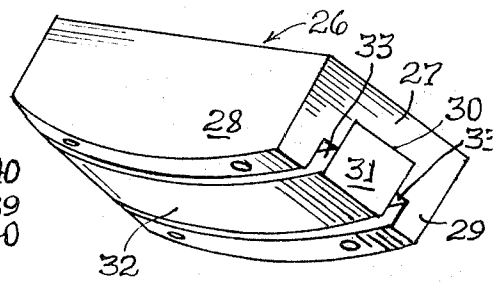


Fig. 4.

ROTATABLE RESILIENT PUNCH AND DIE CUTTER APPARATUS

SUMMARY OF THE INVENTION

A perforating, cutting, or embossing device consisting of a pair of cooperating geared rotating rollers, one of which has mounted on its periphery a punch member comprising a urethane punch having a steel-plated backing, while the other roller provides a designed anvil-type member which consists of a backup element yieldably positioned on a spring steel band overlapping a second cooperating urethane blank, the arrangement being such that the urethane punch will be compressed upon the material to be perforated, cut, or embossed, as it passes between the rollers during their rolling engagement, with the compression causing a flow of urethane upon the backup element so as to cause the same to retract against the spring steel band and urethane blank a sufficient amount to cause the material to be perforated, cut, or embossed in the form corresponding to the shape or arrangement of the backup element.

When pressures are applied to the urethane punches, such as by compression between the rollers, the extreme resilient characteristics of the urethane permit it to temporarily deform to the shape, form and design of the anvil or die plate. Since the urethane is non-compressible in contrast to being deformable, it has the effect of being a solid liquid and performs like a confined hydraulic fluid within the limitations of its deflection range; thus, in the present apparatus, it becomes the punch for perforating, or the blade for cutting, or a designed cutter for embossing.

GENERAL DESCRIPTION

The invention will be best understood by reference to the enclosed drawings showing a preferred form of the invention as used in a tape perforator. While the preferred form is thus shown, the description is not limited to that particular function of the invention but, as shown and illustrated in detail in the accompanying drawings, there is shown in:

FIG. 1 a front elevational view of the invention;

FIG. 2 a side elevational detail sectional view of the invention;

FIG. 3 a fragmentary detailed perspective view of the invention in operation;

FIG. 4 a perspective view of the urethane punch carrier as embodied in the invention.

Referring to FIG. 1, the embodiment shown therein comprises a perforating apparatus 10 consisting of a frame base 11 and two upstanding spaced parallel side walls 12 and 13. On the exposed side of the wall 13 there are suitably mounted a pair of reduction gears 14 and 15.

The reduction gear 15 is rotatably journaled on a shaft 16 which extends through the side walls 12 and 13 and carries on the exposed side of the side wall 12 a drive gear 17. This drive gear 17 meshes with a driven gear 18 rotatably carried on a shaft 19 which projects through the side walls 12 and 13.

Adapted to be rotatably mounted on the shafts 16 and 19 are a pair of cooperating rollers 20 and 21, the arrangement being such that the reduction gear 14 is associated with a power shaft 23 which in its normal operation will rotate the reduction gears 14 and 15 and in turn operate the drive gear 17 and the driven gear

18, causing the rollers 20 and 21 to rotate in opposite directions.

The uppermost roller 20 has its periphery 24 segmentally relieved so as to provide equally spaced cavities 25. Adapted to be fixedly mounted in each of the cavities 25 is a carrier 26.

As viewed in FIG. 4, this carrier 26 is preferably formed of a metal U-shaped body 27, with the extremities of the arms 28 and 29 thereof arcuated so as to correspond to the circumference of the roller 20. The medial portion of the body 27 between the legs 28 and 29 is channeled as at 30 so as to receive therein a urethane block 31. The urethane block 31 provides an exposed arcuate surface 32 that extends beyond the circumference of the roller 20. Between the urethane block 31 and the arms 28 and 29 of the body 27 of the carrier 26, there are provided channels 33, the purpose of which will be hereinafter made apparent.

The cooperating roller 21 has its periphery 34 likewise segmentally relieved so as to provide recesses 35 into which is frictionally positioned an insert of urethane 36. The urethane insert 36, however, has its exposed edge arcuated so as to conform to the periphery of the roller 21 as shown. Encircling the periphery 34 of the roller 21 as well as the exposed arcuated surface of the urethane insert 36, is a spring steel band 37. Encircling the spring steel band 37 is a metallic anvil 38 which, in the illustrated embodiment of the invention, has formed therein a plurality of apertures 39. Each of these apertures 39 contains a backup pin 40.

The roller 21 is provided with a pair of side plates 41 and 42 which have a diameter larger than the diameter of the roller 21 so as to be disposed beyond the periphery of the metallic anvil 38. When the rollers 20 and 21 are mounted upon the frame of the device as shown, the periphery of the side plates 41 and 42 will ride in the channels 33 formed between the urethane punch 31 and the arms 28 and 29 of the body 27 of the carrier 26, as shown in the drawings.

From the foregoing description, when a strip or web of material 43 is caused to pass between the rotating rollers 20 and 21, the urethane punch 31 will be slightly compressed between a first surface which comprises the exposed peripheral face of the anvil 38 and its carrier 26 in a progressive front-to-back relationship whereby the deforming characteristics of the urethane will flow against a second surface comprising the resiliently contained backup pins 40 and into the apertures 39 formed in the anvil 38. By depressing the pins 40 the remaining edges of the apertures become cutting surfaces that will cause removal of material from the web 43 corresponding to the pattern of the apertures 39 formed in the anvil 38. If the device did not contain the resiliently held backup pins 40, the flow of the urethane into the exposed apertures 39 would not be uniform and thus would not result in uniform perforation of the material, as desired. This desired effect is caused by the fact that the backup pins 40 form some yieldable resistance to the deforming urethane punch before it will compress the backup pins and the corresponding portions of the web 43 into the apertures 39 a sufficient degree to result in uniform perforation of the web 43.

The urethane punch 31 performs its function because in effect it is contained in a restricted area bounded by the base of the channel 30, the ends of the cavities 25, and on either side by the side plates 41 and 42, which project into the channels 33 provided by the urethane

punch 31 and the arms 28 and 29 of the carrier 26. In such restricted area, the urethane can only flow in the direction of the anvil 38 and thus is forced to perform the desired operating function.

The apparatus 10 is provided with a scavenger blade 44 which is carried by a suitable bracket 45 mounted on the frame base 11, with its knife edge exposed between the side plates 41 and 42 and in contact with the exposed peripheral face of the anvil 38 to remove the relieved material of the strip 43 from the roller 21 for clean, continuous operation.

It may be noted that the anvil 38 may be formed to provide a transverse slot rather than the apertures 39, which would contain a backup member that in effect would cause the cutting or severing of the tape 43 periodically as it passed between the rollers 20 and 21. The anvil 38 may also be provided with a pre-designed groove having a resilient backup member, the resilience being of such degree that it prevents complete perforation or cutting of the material 43 so as to emboss the material, rather than perforating or cutting the same.

While I have illustrated and described the preferred form of construction for carrying my invention into effect, this is capable of variation and modification without departing from the spirit of the invention. I, therefore, do not wish to be limited to the precise details of construction set forth, but desire to avail myself of such variations and modifications as come within the scope of the appended claims.

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

1. A rotatable resilient punch and die cutter apparatus adapted to act upon a traveling web of sheet material so as to perforate, cut or emboss the same, comprising
 - a. a pair of rollers, the peripheries of which are in rolling engagement with opposite surfaces of the traveling web of material,
 - b. punch means on one of said rollers providing an exposed resilient deformable surface extending beyond the periphery of said one roller,
 - c. means on said other roller providing a first annular surface contacting said exposed surface of said punch means to deform the same upon the traveling web of material, and
 - d. a second yieldable surface provided by said other roller movable from beneath the web of material by said deformed surface of said punch means so as to expose a cutting edge beneath the web adapted to cooperate with said punch means as it acts upon the web of material during its travel between said rollers.
2. A rotatable resilient punch and die cutter apparatus as defined by claim 1 wherein said means on said other roller providing a first annular surface comprises

a metallic anvil-forming ring embracing said other roller and providing an annular surface adapted to have rolling contact with said punch means on said one of said rollers.

3. A rotatable resilient punch and die cutter apparatus as defined by claim 1 wherein said second yieldable surface provided by said other roller comprises pins contained in apertures formed in said first annular surface, said pins having a yieldable backing against which they are compressed by said deformed surface of said punch means, together with that portion of the web of material acted upon by said deforming surface of said punch means.

4. A rotatable resilient punch and die cutter apparatus as defined by claim 2 wherein said second yieldable surface provided by said other roller comprises a plurality of pins contained in apertures formed in said metallic anvil-forming ring, said pins having a yieldable backing against which they are compressed by said deformed surface of said punch means, together with that portion of the web of material acted upon by said deforming surface of said punch means.

5. A rotatable resilient punch and die cutter apparatus as defined by claim 1 wherein said punch means comprises a deformable resilient material providing an exposed arcuate surface defining the axially extending area of deformation of said punch means during its rotatable contact with the web of material and said other of said rollers.

6. A rotatable resilient punch and die cutter apparatus as defined by claim 2 wherein said punch means comprises a deformable resilient material providing an exposed arcuate surface defining the axially extending area of deformation of said punch means during its rotatable contact with the metallic anvil-forming ring carried by said other of said rollers.

7. A rotatable resilient punch and die cutter apparatus as defined by claim 3 wherein said punch means comprises a deformable resilient material providing an exposed arcuate surface defining the axially extending area of deformation of said punch means during its rotatable contact with said first annular surface and forming the cutting elements forcibly projected upon said web of material and said pins so as to compress the same against their yieldable backing.

8. A rotatable resilient punch and die cutter apparatus as defined by claim 4 wherein said punch means comprises a deformable resilient material providing an exposed arcuate surface defining the axially extending area of deformation of said punch means during its rotatable contact with said first annular surface and forming the cutting elements forcibly projected upon said web of material and said pins so as to compress the same against their yieldable backing.

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