United States Patent [19]

Lawson et al.

[11] **3,894,697**

[45] **July 15, 1975**

[54] **PAPER SHREDDER**

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[73] Assignee: **Pitney-Bowes, Inc.**, Stamford, Conn.

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[21] Appl. No.: **462,322**

[52] **U.S. Cl.** **241/159**; 241/236

[51] **Int. Cl.**[2] **B02C 21/00**

[58] **Field of Search** ..... 241/152 A, 152 R, 157, 241/159, 227, 236

[56] **References Cited**

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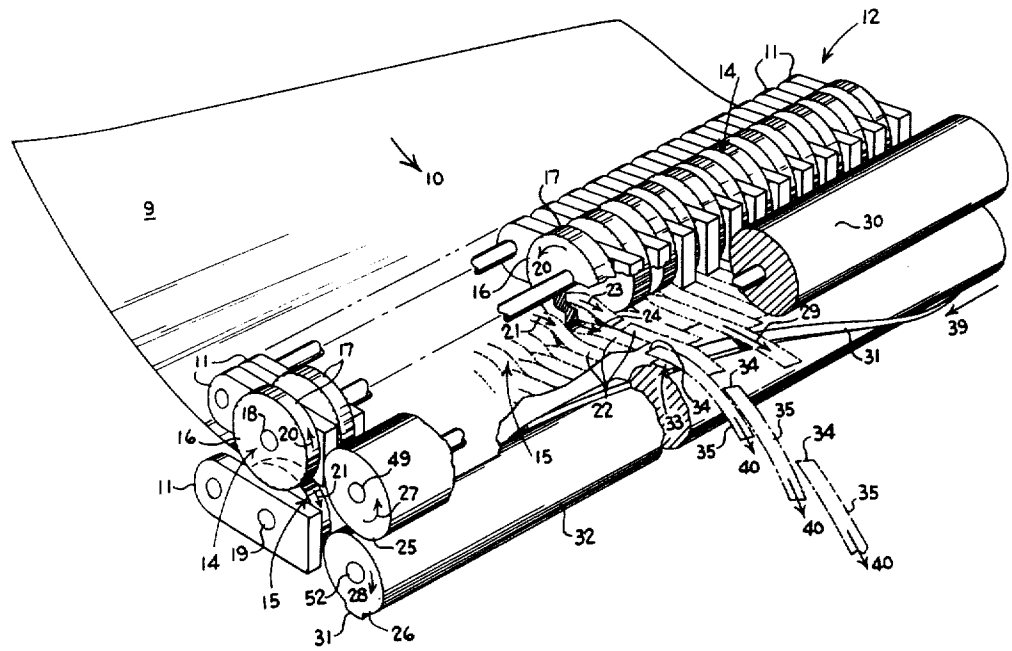
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Primary Examiner—Granville Y. Custer, Jr.
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Attorney, Agent, or Firm—William D. Soltow, Jr.; Albert W. Scribner; Robert S. Salzman

[57] **ABSTRACT**

A sheet material shredding mechanism comprising a pair of strip forming rollers and a pair of shredding rollers. Sheet material, such as paper documents, is initially fed into the jaws of the shredding mechanism. The sheets of material are then drawn between the strip forming rollers, which comprise intermeshing serrated discs. The serrated discs grab the material and form the material into strips. The shredding rollers, which are located directly adjacent to the strip forming rollers, receive the stripped material, and break the strips into smaller pieces. The shredding rollers comprise a smooth roller which is in shredding engagement with a mating roller having a raised strip which spirals along the length of the roller to form a helix. Strips fed to the shredding rollers are progressively torn across the width of the document as the raised spiral strip portion rotates into engagement with its mating roller.

5 Claims, 5 Drawing Figures



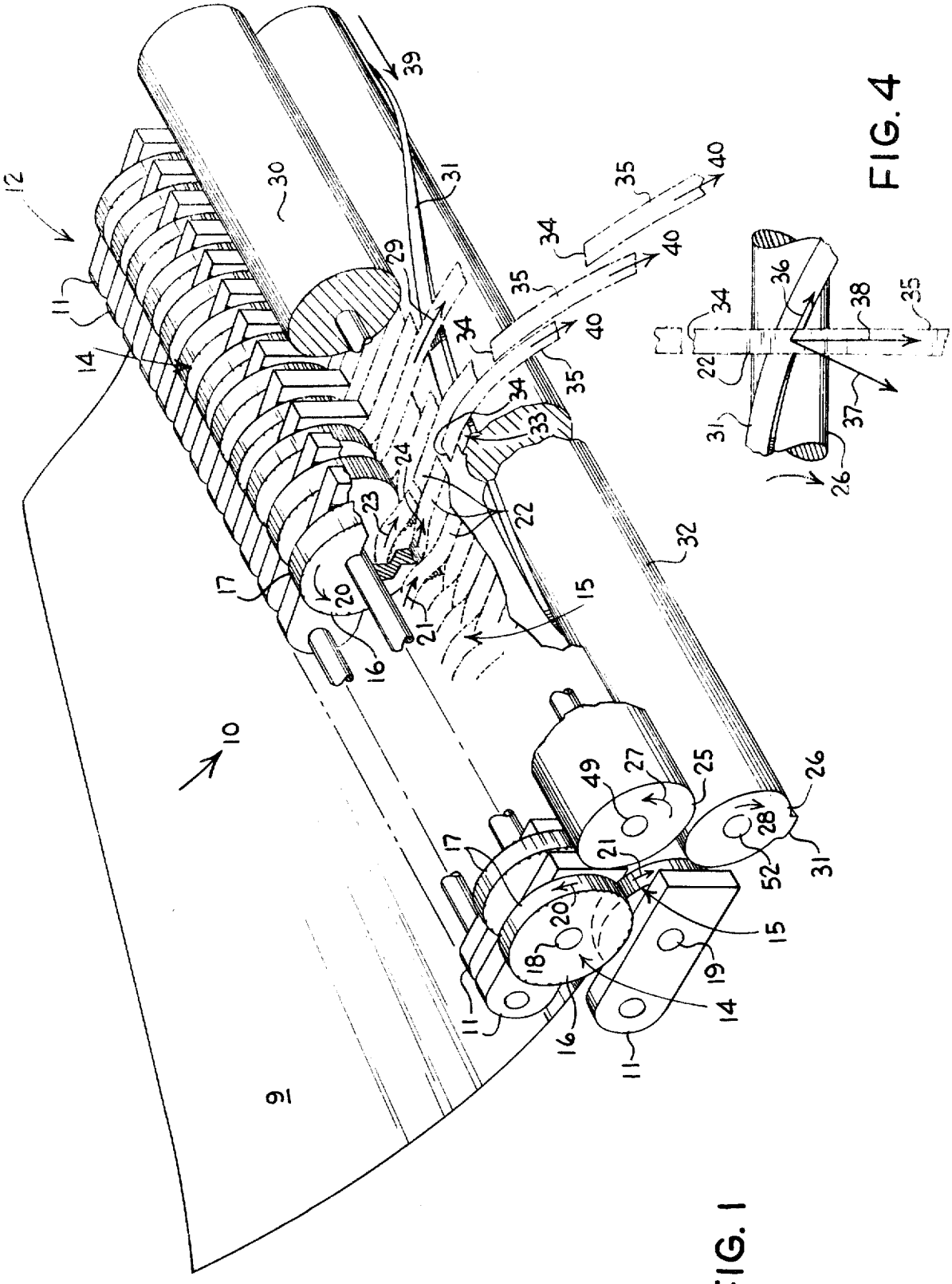

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FIG. 1

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FIG. 4

FIG. 3

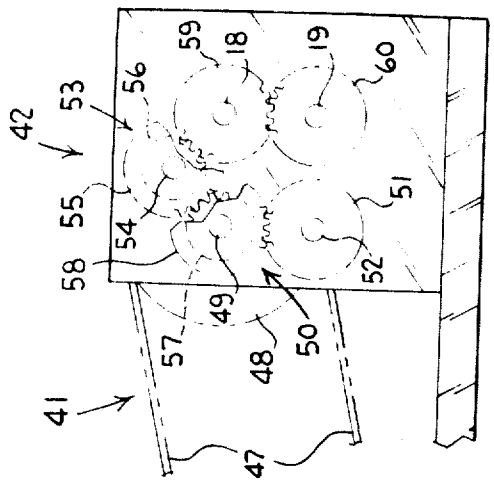


FIG. 1a

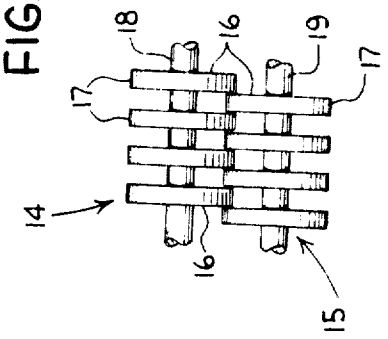
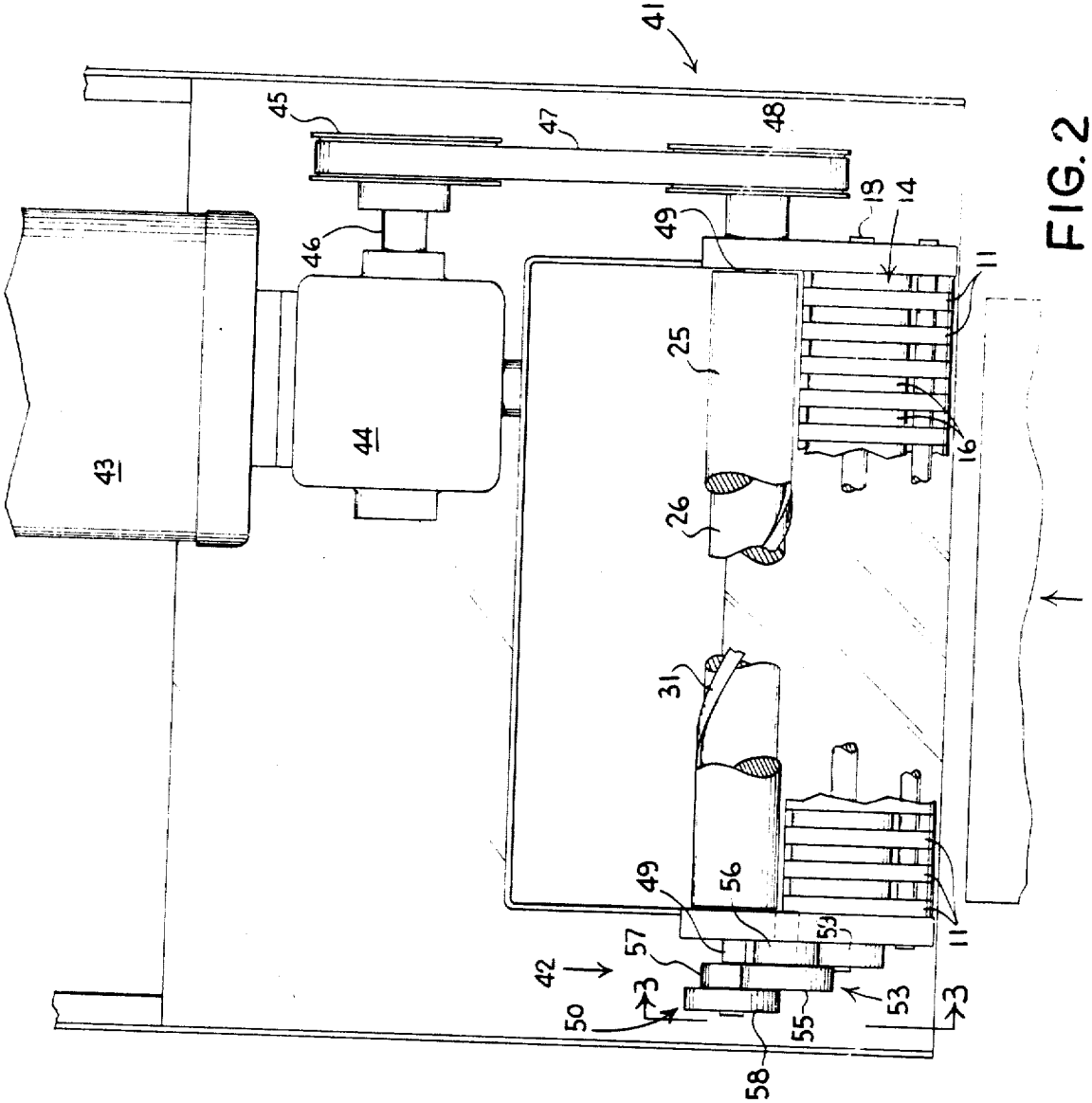


FIG. 2



PAPER SHREDDER

The invention pertains to shredding devices and more particularly to a shredding mechanism which first causes the material to form into strips and then causes the strips to break into smaller strips.

BACKGROUND OF THE INVENTION

Heretofore, shredding devices have usually first cut or sheared documentary sheet material into a number of narrow strips. Devices of this kind may be seen in the patents issued to:

H. W. Wilson
U.S. Pat. No. 1,966,109
Issued: July 10, 1934;
J. Pelleschi et al.
U.S. Pat. No. 3,620,461
Issued: Nov. 16, 1971.

With the Pelleschi shredder, the strips are then cut into smaller pieces by a rotating cutter having a plurality of blades. One disadvantage of using a blade cutter for further disintegration of the strips of material is that the blades of the cutter have a tendency to become dull with use. When this happens, the strips are not cleanly separated into smaller pieces, and a poorer quality of shreds is produced.

In order to avoid this problem, the present invention uses a novel pair of shredding rollers, which tear the strips into smaller strips. The need for cutter blades is thus avoided.

SUMMARY OF THE INVENTION

The shredder mechanism of this invention comprises a pair of rotating strip forming rollers and a pair of rotating shredding rollers. Sheet material is fed into the jaws of the mechanism and is drawn into the strip forming rollers. The strip forming rollers each comprise a set of knurled or serrated discs. The set of discs of each roller intermeshes with the other set of discs of the other roller. As the sheet material is drawn between the strip forming rollers, the intermeshing discs shear the material into strips. These strips are then fed between the rotating shredding rollers which tear these strips into smaller strip pieces. The shredding rollers comprise a smooth roller which is in shredding engagement with a mating roller having a raised strip portion which spirals about the circumferential surface of the roller to form a helix. As the strips are fed between the shredding rollers, they are progressively inched between the raised strip and the smooth mating roller as the rollers turn. This causes the strips to be torn into smaller strips. The strips will be progressively torn in seriation across the width of the documents, as the spiral strip progressively engages the strips as the rollers turn toward each other. This progressive tearing reduces the power requirements needed to drive the roller.

The surface speed of rotation of the shedding rollers is always higher than that of the strip forming rollers. This differential in surface speed is necessary for the tearing of the strips.

It is an object of this invention to provide an improved shredding mechanism; it is another object of the invention to provide a shredding mechanism which is of simple construction, low in cost, and which is reliable in its operation. It is a further object of this invention to provide a shredding mechanism which first causes sheet material to form into narrow strips, and then tears these strips into smaller strip pieces.

These and other objects of this invention will become more apparent and will be better understood with reference to the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. **1** is a perspective view of the shredding mechanism of this invention.

FIG. **1***a* is a frontal view of the sets of stripping discs of the shredding mechanism of FIG. **1.**

FIG. **2** is a top view of the shredding mechanism of FIG. **1,** and further including the drive train and gearing components.

FIG. **3** is a side view of the gearing and drive train of FIG. **2** taken along lines **3—3.**

FIG. **4** is a vector diagramatic view of a strip of material being torn by the shredding rollers of FIG. **1.**

Generally speaking, the invention is a shredding mechanism for shredding sheet material. The shredding mechanism comprises means for receiving sheet material to form them into strips. The strips are then introduced to a pair of oppositely rotating shredding rollers located adjacently to the strip forming means. The shredding rollers receive the strips therebetween, and shred the strips into smaller pieces of material. One of the shredding rollers has a raised portion disposed upon its circumferential surface. The raised portion periodically rotates into stripping engagement with the other shredding roller of the pair. This action causes the strips to shred. Means are also provided to rotate the shredding rollers into stripping engagement with each other.

Now referring to FIG. **1,** a sheet **9** is shown being fed (arrow **10**) between the jaws **11** of a shredding mechanism generally depicted by arrow **12.** The jaws **11** are fixedly mounted, and act as guides for the sheet **9.** The jaws **11** introduce the sheet **9** between two rotating sets **14** and **15,** respectively, of intermeshing discs **16** (see FIG. 1a). The individual discs **16** each have a serrated circumferential surface **17** for frictionally gripping the sheet **9.** The disc sets **14** and **15** are mounted for rotation upon respective shafts **18** and **19.** The disc set **14** rotates (arrow **20**) in an opposite direction to the rotation (arrow **21**) of disc set **15.** This opposite rotation of the disc sets causes the sheet **9** to be drawn (arrow **10**) into the mechanism.

The intermeshing of discs **16** causes the sheet **9** to shear and separate into strips **22** as the sheet is fed between the discs. Half of the strips **22** being forced over the lower discs (arrow **23**), and the other half of the strips being forced under the upper discs (arrow **24**).

Strips **22** are next fed to a pair of shredding rollers **25** and **26,** respectively. The shredding rollers **25** and **26** rotate in opposite directions (arrows **27** and **28,** respectively) so as to draw the strips therebetween (arrow **29**).

The upper shredding roller **25** has a smooth circumferential surface **30,** while the lower shredding roller **26** has a raised elongated strip section **31.** The raised strip is spirally wound about the circumferential surface **32** of roller **26** so as to form a helix. The helix extends across the entire length of roller **26.**

As the shredding rollers **25** and **26** rotate, the raised strip portion **31** of roller **26** periodically and continuously comes into stripping engagement with the smooth surface **30** of roller **25.** Strips of material **22,** which are caught between the raised strip **31** and surface **30** of rollers **25** and **26,** respectively, are caused to be torn as

shown (arrow 33). This tearing results from the fact that the shredding rollers 25 and 26, are rotating at a higher surface speed than the stripping disc sets 14 and 15.

The tear lines 34 of the shredded strips 35 are angularly formed with respect to the length of the strips 35. The angular tear line 34 is the result of the continuously changing point of engagement between the helical strip 31 and surface 30 of roller 25. The changing point of contact causes a lateral tear vector 36 in addition to a vertical tear vector 37 (see FIG. 4). The resultant angular tear vector 38 causes an angular shear line 34 in shredded strip 35.

Strips 22 are progressively shredded (teared) in seriatim across the entire width of sheet 9. This progressive shredding advances across the strips 22 in the direction of arrow 39, which causes the strips 22 to break into smaller strips 35, which progressively spew from between rotating rollers 25 and 26 (arrows 40).

Referring to FIGS. 2 and 3, the drive train 41 and the speed control gearing 42 is shown for the shredding mechanism of FIG. 1. The rollers 25 and 26, and the disc sets 14 and 15 are powered from a motor 43 (FIG. 2) whose speed is reduced by the reduction gear box 44. Pulley 45 is connected to the reduction gearing via shaft 46. The pulley 45 drives a timing belt 47, which in turn drives pulley 48. Pulley 48 is keyed to shaft 49 which also supports and is affixed to roller 25. Therefore, as pulley 48 is made to turn, the roller 25 is likewise made to turn. At the other end of shaft 49 (opposite pulley 48) a compound gear 50 is affixed. Gear 50 has an outer gear 58 which drives gear 51. Gear 51 is keyed to shaft 52, which supports and is affixed to roller 26. Thus, as roller 25 is made to turn, roller 26 is caused to rotate at the same speed, but in an opposite rotational direction.

An intermediate compound gear 53 is mounted for rotation on shaft 54. Intermediate compound gear 53 has an outer gear 55 which is driven by small gear 57, which forms part of compound gear 50. The inner smaller gear 56 of compound gear 53 in turn drives gear 59, which is keyed to shaft 18 supporting and affixed to disc set 14. Gear 59 is in mesh with gear 60, which is secured to shaft 19. Shaft 19 is keyed to disc set 15.

The speed control gearing 42 is arranged by means of intermediate gear 53 to impart a slower speed to disc sets 14 and 15, than to shredding rollers 25 and 26.

Many modifications of this invention will naturally occur to those skilled in this art. For example, stripping discs 16 may be replaced, if so desired, by cutting wheels. Strip 31 may be replaced by several strips. Strips can have other configurations other than a helical configuration. The shape, size and number of strips 31 may be varied to provide different shredding effects.

All such modifications which would be obvious to the skilled practitioner are deemed to lie within those limits defining this invention. The spirit and scope of the invention is defined by the appended claims.

What is claimed is:

1. A shredding mechanism for shredding sheet material, comprising:

strip forming means for receiving sheet material and causing said sheet material to form into strips of material;

a pair of oppositely rotating shredding rollers located adjacent the strip forming means for receiving therebetween said strips of material from said strip forming means and causing said strips of material to be shredded into smaller pieces of material, one of said shredding rollers of said pair having at least one raised portion disposed upon a circumferential surface thereof, which said raised portion periodically rotates into shredding engagement with the other roller of said pair of shredding rollers so as to shred said strips of material as said rollers oppositely rotate with respect to each other said strip forming means comprising a pair of oppositely rotating strip forming disc sets, and said shredding rollers rotating at a higher surface speed than the strip forming disc sets; and

driving means operatively connected to said shredding rollers for rotating said shredding rollers into shredding engagement with each other.

2. The shredding mechanism of claim 1, wherein said raised portion is an elongate strip disposed upon the circumferential surface of said shredding roller.

3. The shredding mechanism of claim 2, wherein said elongate strip forms a helix upon the circumferential surface of said shredding roller.

4. The shredding mechanism of claim 3, wherein said elongate strip is disposed substantially along an entire length of said shredding roller.

5. The shredding mechanism of claim 1, wherein each said strip forming disc set, comprises stripping discs, the stripping discs of each set intermeshing with the stripping discs of the other set.

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