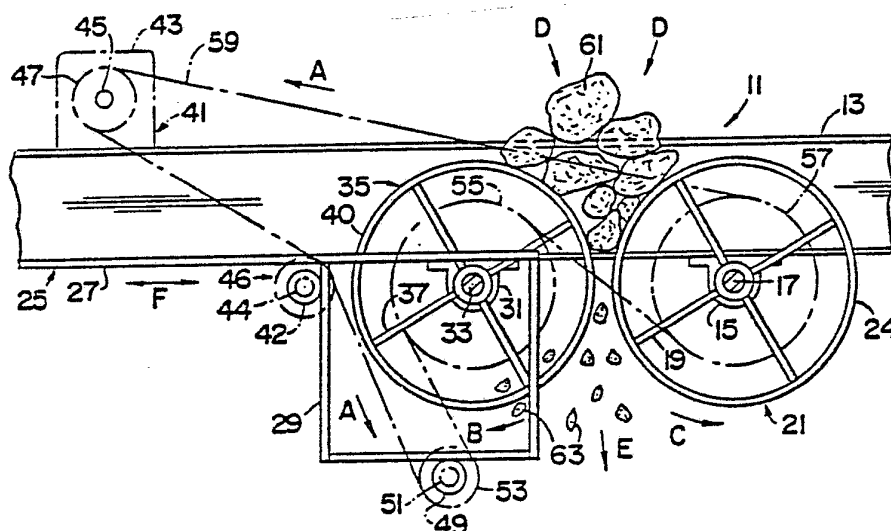




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: APPARATUS FOR BREAKING ASPHALT



## (57) Abstract

An apparatus (11) for breaking asphalt having a pair of parallel counter rotating perforate hollow cylindrical members (21, and 35). The interval between the centers of the cylindrical members (21 and 35) can be adjusted so that large particles (61) of asphalt can be loaded on the nip defined by the two cylindrical members (21 and 35) and then crushed into uniform smaller pieces (63) of predetermined size.

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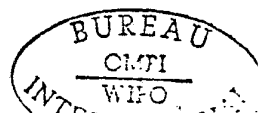
## APPARATUS FOR BREAKING ASPHALT

## BACKGROUND OF THE INVENTION

This invention relates in general to crushing and grinding apparatus, and in particular to an apparatus for breaking asphalt into substantially uniform pieces of a predetermined size for recycling.

A number of devices have been employed over the years to crush or grind different materials. For example in U. S. Patent 5,440 (DeHaven), a machine is described for breaking up coal into smaller particle sizes, employing a rotating drum having a series of teeth meshing with holes in a fixed plate. The drum is provided with a plurality of apertures through which the coal may fall. In U. S. Patent 3,933,086 (Standing) a machine for separating dried fruit aggregates is disclosed and includes a pair of rollers having teeth along their respective peripheries for separating individual fruit pieces by the differential speed of the pairs of rollers. In another reference, U.S. Patent 271,589 (Anderson), a pair of flexible crushing rolls or cylinders are disclosed with peripheral slotted perforations, through which clay is forced by the pressing and abrading action of the rolls into the interior of the rolls and thereafter subjected to the actions of cutters or beaters. Other references of interest include U.S. Patent 175,774 (Siehmon); U.S. Patent 1,753,210 (Melville); U.S. Patent 44,408 (Dickson); U.S. Patent 1,079,301 (Lloyd); U.S. Patent 4,131,238 (Tarpley); and U.S. Patent 1,135,795 (Hiller).

The devices referred to in the references



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listed above, are not particularly suitable for breaking up asphalt into small uniformly sized pieces which can be recycled efficiently. Furthermore, none of these devices disclose means for varying the size  
5 of the final, crushed product as by moving one of the crushing members.



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## SUMMARY OF THE INVENTION

The present invention relates to an apparatus for breaking asphalt into substantially uniform pieces of a predetermined size, so that the resulting smaller pieces may be recycled. The apparatus is characterized by its construction comprising a pair of parallel, counter rotating perforate hollow cylinders. One of the cylinders is movable along a direction transverse to axis of rotation, whereby the distance between the two counter rotating cylinders may be varied in predetermined fashion. The invention is further characterized by the providing of a plurality of apertures, preferably in the form of rectangles, through each cylinder. In the operative disposition of the apparatus, the apertures formed through each cylinder are in a nonaligned relation to each other. That is to say, the apertures formed through one cylinder are not substantially congruent to the apertures of the other cylinder.

The invention accordingly comprises the features of construction, combination of elements, and arrangement of parts which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims.

## BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:



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FIG. 1 is a side view of the apparatus for breaking asphalt of the present invention.

FIG. 2 is a top plan view, in fragmentary detail, of the adjacent hollow cylindrical drums of the present invention.

Similar reference characters refer to similar parts throughout the several views of the drawings.

#### DETAILED DESCRIPTION

Illustrated in Figure 1 is a side view of the apparatus generally indicated at 11, for breaking asphalt. The apparatus 11 includes a supporting structure 13 which is disposed substantially horizontally and may comprise a pair of parallel I-beams mounted on legs (not shown) on a supporting surface (not shown). Attached to the horizontal supporting structure 13 are a first pair of bearing hangers 15 which support a shaft 17. Attached to the shaft 17 are a plurality of spokes 19 radiating outwardly and connected to a first hollow cylindrical drum 21. As better illustrated in Figure 2, the first hollow cylindrical drum 21 is substantially perforate since it is provided with a plurality of radially extending apertures 23 disposed in an arranged pattern through the first drum surface 24. The radially extending apertures 23 are substantially rectangular projections on the cylindrical surface 24 of the first hollow cylindrical drum 21. The radially extending apertures 23 are shown disposed in a uniform cylindrical matrix arrangement in Figure 2.

As illustrated in Figure 1, the apparatus 11 for breaking asphalt also includes a sliding assembly 25



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disposed on the bottom surface of the horizontal supporting structure 13. Sliding assembly 25 includes a pair of elongated traverse posts 27 which are adapted to slide on the base surface of the I-beams forming the horizontal supporting structure 13. The elongated traverse posts 27 may be in the form of a reversed "C" disposed on the base portion of the I-beam. The sliding assembly 25 also includes a pair of underframes 29 which are attached to the elongated traverse posts 27 and form a substantially rectangular underframe. Attached to the sliding assembly 25 are a second pair of bearing hangers 31 which provides bearing support for a second shaft 33. The second shaft 33 is attached to a second hollow cylindrical drum 35 by a plurality of radially disposed second spokes 37. As illustrated in Figure 2 the second hollow cylindrical drum 35 is also provided with a plurality of radially extending openings 39 arranged in a predetermined pattern on the surface 40 of the drum 35. The pattern on the drum 35 and the drum 21 are arranged so that when they are juxtaposed the pattern on the drum 21 is offset from the pattern of the drum 35. The offset can be achieved by creating different patterns for the drums 21 and 35, or alternatively, by disposing identical drums 21 and 35 slightly offset longitudinally with regard to their axes of rotation.

The apparatus 11 is driven by a drive mechanism 41. The power for the drive mechanism is provided by a motor 43 having an output shaft 45 connected to a motor sprocket 47. Also included in the drive mechanism 41 is a first idler bearing hanger 42 supporting a first idler shaft 44 to which a first idler sprocket 46 is attached.



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The first idler bearing hanger 42 may be attached to the upper portion of the underframe 29 or to the bottom portion of the elongated traverse post 27. A second idler bearing hanger 49 is attached to the bottom of the underframe 29 to support a second idler shaft 51 which is attached to a second idler sprocket 53. A second drum sprocket 55 is attached to the second shaft 33 which is connected with the second hollow cylindrical drum 35. A first drum sprocket 57 is connected to the first shaft 17, which is connected to the first cylindrical hollow drum 21. A roller chain 59 is operatively connected to motor sprocket 47 on the drive shaft 45. The roller chain 59 is also connected to first idler sprocket 46, second idler sprocket 53, and second and first sprockets 55 and 57, respectively.

The operation of the device is illustrated in Figure 1 which indicates the direction of travel of the roller chain 59 with arrows A. Drive shaft 45 turns counterclockwise thereby causing the chain 59 to turn the second hollow cylindrical drum 35 in a clockwise direction as indicated by arrow B. While at the same time turning first hollow cylindrical drum 21 in a counterclockwise direction as indicated by arrow C. The counter rotating drums 21 and 35 provide the necessary stresses on large particles of asphalt 61 to break the large particles 61 into smaller particles 63. The size of the smaller particles 63 can be controlled by the spacing between the two drums 21 and 35 which in turn can be controlled by the sliding assembly 25. The size of, the openings 23 and apertures 39 are also determinative of the size of the smaller particles 63.



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As can be appreciated by the geometry of the drums 21 and 35 (and illustrated in Figure 1) particles of asphalt can fall through into the interior portion of the hollow cylindrical drums 21 and 35. These smaller particles 63 will then fall out due to the action of gravity.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description are efficiently attained, and, since certain changes may be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Now that the invention has been described,



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## What Is Claimed Is

1. An apparatus for breaking asphalt comprising:
  - a first hollow drum having a longitudinal axis and a cylindrical outer surface provided with a plurality of radially extending openings;
  - a second hollow drum having a central axis and a cylindrical outer surface provided with a plurality of radially extending apertures, said second drum disposed with said central axis parallel to said longitudinal axis, and said apertures disposed about said central axis in a nonaligned relation to the disposition of said openings about said longitudinal axis;
  - means for rotating each of said drums opposite to each other; and
  - means for varying the distance between said longitudinal axis and said central axis
2. The apparatus of claim 1 wherein said openings have the shape of a rectangular projection on said cylindrical outer surface.
3. The apparatus of claim 1 wherein said apertures have the shape of a rectangular projection on said cylindrical outer surface.
4. The apparatus of claim 1 wherein said means for rotating comprises:
  - a first shaft disposed along said longitudinal axis;
  - a plurality of spokes coupling said first shaft to said first hollow drum;
  - a second shaft disposed along said central axis;



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a plurality of spokes coupling said second shaft to said second hollow drum; and

means coupled to said first and second shaft for turning said first shaft opposite to said second shaft.

5. The apparatus of claim 4 wherein said means for turning comprises:

motor means for providing rotary power;

a first sprocket attached to said first shaft;

a second sprocket attached to said second shaft; and a chain operatively connected to said motor means and disposed in driving relation to said first sprocket and to said second sprocket, whereby said first sprocket and said second sprocket are caused to rotate toward each other.

6. The apparatus of claim 5 further comprising at least one idler sprocket connected to said chain intermediate said first and second sprockets.

20 7. An apparatus for breaking asphalt comprising: a substantially horizontally disposed supporting structure;

a first hollow perforated cylindrical member pivotally attached to said supporting structure;

25 a sliding member disposed on and supported by said supporting structure;

a second hollow perforated cylindrical member pivotally coupled to said sliding member; and

means coupled to said first and second cylindrical members for counter rotating said first and second cylindrical members toward each other.



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8. The apparatus of claim 6 wherein said first and second hollow perforate cylindrical members each comprises:

a hollow cylinder having a plurality of  
5 openings disposed in a predetermined pattern, said openings extending radially through said cylinder.

9. The apparatus of claim 7 wherein the axes of said first and second cylindrical members are parallel.

10. The apparatus of claim 7 wherein the  
10 predetermined pattern of said openings of said first cylindrical member is longitudinally offset from the predetermined pattern of said openings of said second cylindrical member.

11. The apparatus of claim 6 wherein said  
15 supporting structure comprises a pair of parallel I-beams.

12. The apparatus of claim 11 wherein said sliding member comprises:

a pair of elongated traverse posts each  
20 disposed on the upper surface of the base of a respective one of said I-beams;

a pair of underframes each attached to a respective one of said traverse beams.

13. The apparatus of claim 11 wherein said means  
25 for rotating comprises:

motor means for providing rotary power;  
a first sprocket coupled to said first  
cylindrical member;

a second sprocket coupled to said first  
30 cylindrical member;



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at least one idler sprocket supported by  
said underframes; and

an endless drive chain connected to said  
motor means and operatively disposed around said idler  
5 sprocket, said second sprocket, and said first sprocket,  
whereby said first and second cylindrical members may be  
counter rotated toward each other.



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FIG. 1

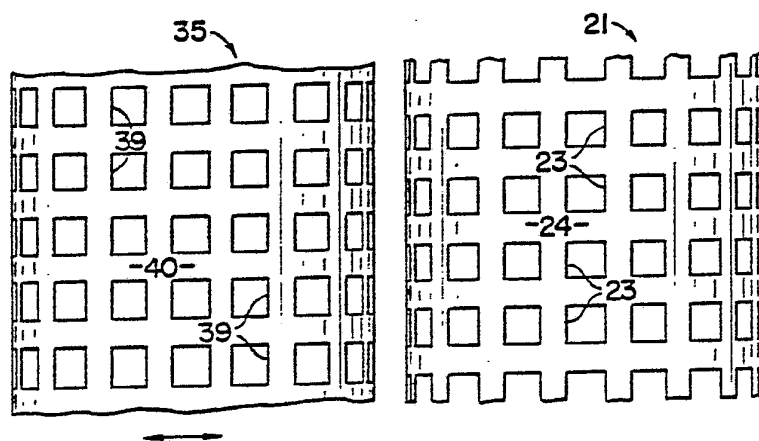
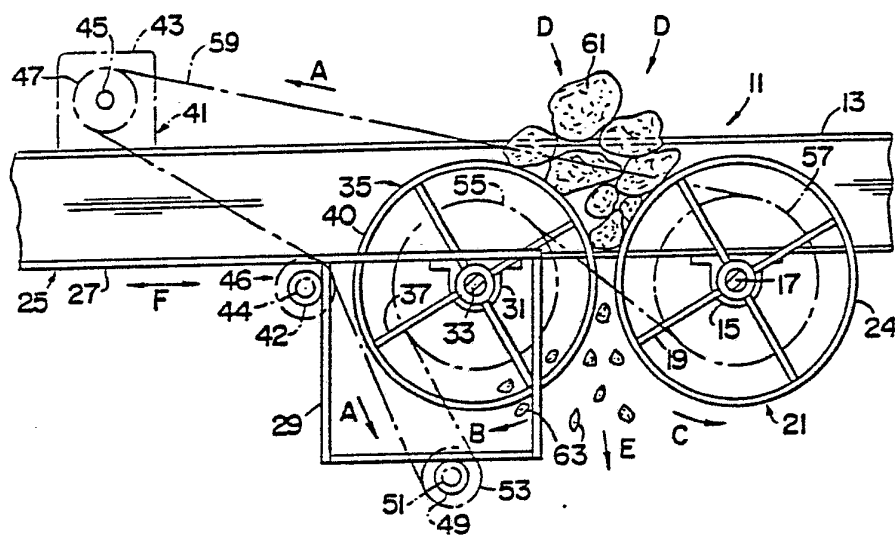
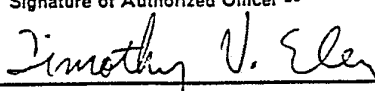


FIG. 2

# INTERNATIONAL SEARCH REPORT

International Application No PCT/US83/00400

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|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-------------------------------------|
| <b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) <sup>3</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                |                                     |
| According to International Patent Classification (IPC) or to both National Classification and IPC <sup>3</sup> .4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                |                                     |
| 241/230 B02C 4/02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                |                                     |
| <b>II. FIELDS SEARCHED</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                |                                     |
| Minimum Documentation Searched <sup>4</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                |                                     |
| Classification System                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Classification Symbols                                                                                         |                                     |
| U. S.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 241/85, 87, 93, 228, 230, 234, 235                                                                             |                                     |
| Documentation Searched other than Minimum Documentation<br>to the Extent that such Documents are Included in the Fields Searched <sup>5</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                |                                     |
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| <b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> <sup>14</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                |                                     |
| Category <sup>*</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Citation of Document, <sup>16</sup> with indication, where appropriate, of the relevant passages <sup>17</sup> | Relevant to Claim No. <sup>18</sup> |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | US,A, 342,811 G. R. Root 01 June 1886                                                                          | 1-13                                |
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| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | US,A, 2,833,481 R. L. Perks 06 May 1958                                                                        | 1-13                                |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | US,A, 3,208,677 M. C. Hesse 28 September 1965                                                                  | 1-13                                |
| <p><sup>*</sup> Special categories of cited documents: <sup>15</sup></p> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>"A" document defining the general state of the art</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document cited for special reason other than those referred to in the other categories</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> </div> <div style="width: 45%;"> <p>"P" document published prior to the international filing date but on or after the priority date claimed</p> <p>"T" later document published on or after the international filing date or priority date and not in conflict with the application, but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance</p> </div> </div> |                                                                                                                |                                     |
| <b>IV. CERTIFICATION</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                |                                     |
| Date of the Actual Completion of the International Search <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Date of Mailing of this International Search Report <sup>2</sup>                                               |                                     |
| 09 June 83                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 24 JUN 1983                                                                                                    |                                     |
| International Searching Authority <sup>1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Signature of Authorized Officer <sup>20</sup>                                                                  |                                     |
| ISA/US                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                            |                                     |