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54 **Apparatus and method for classifying heterogeneous solids.**

57 When classifying heterogeneous solids by passing them over a disc screen (4) formed by a number of rollers (6) rotating about parallel axes disposed in a common horizontal plane there is a tendency for smaller solids to rest on top of larger solids during their passage across the screen. However this difficulty is mitigated by providing a second disc screen (5) below the first so that the solids tumble from the upper screen (4) onto the lower screen (5).

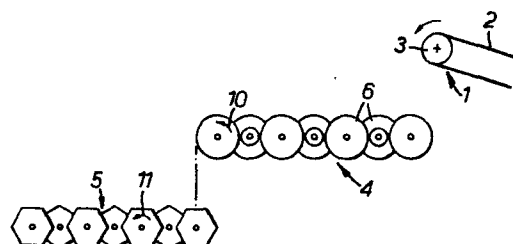


FIG. 1.

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APPARATUS AND METHOD FOR CLASSIFYING HETEROGENEOUSSOLIDS

This invention relates to an apparatus and method for classifying heterogeneous solids.

One method which has been used in the past to classify heterogeneous solids, in particular refuse, employs a disc screen. Such a screen is formed by a number of rollers rotating in the same direction about parallel axes disposed in a common horizontal plane. Each roller has a hub section on which radially extending discs are mounted, the location of the discs of one roller being staggered in relation to the discs on an adjacent roller and intermeshing with the discs on an adjacent roller to define apertures between adjacent discs and adjacent rollers. In operation the rollers are rotated in a common direction and refuse is fed onto the front end of the screen. Solids larger than the apertures formed between adjacent rollers are conveyed right across the screen owing to the rotation of the rollers while

smaller solids fall through the apertures of the screen and can thus be separated. However it has been found that smaller solids may rest on top of larger solids during their passage across the
5 screen and are therefore not separated; this difficulty is particularly noticeable when the larger solids are of sheet-like form.

It is an object of the invention to provide an improved apparatus for classifying heterogeneous
10 solids.

It is another object of the invention to provide an improved method for classifying heterogeneous solids.

According to the invention an apparatus for
15 classifying heterogeneous solids comprises a first assembly of rollers mounted for rotation about substantially parallel axes, each roller comprising a hub portion and a plurality of radially extending disc portions, the disc portions of each roller
20 intermeshing with those of the or each adjacent roller and terminating adjacent the or each adjacent roller to define apertures therebetween, and drive means for rotating the rollers in a common direction, wherein a second assembly of rollers is provided
25 having the features of the first assembly as defined above the arrangement being such that in use solids passing over the first assembly fall from the downstream end of the first assembly onto the upstream end of the second assembly.

30 The space between the first and second assemblies through which in use the solids fall is preferably unobstructed so that the fall of the solids is a free fall.

The fall should be of sufficient height to ensure that smaller solids supported on larger solids are most likely to be dislodged by the fall.

5 Preferably the arrangement is such that, in use, the solids fall through a distance greater than the outer diameter of the disc portions of the rollers. Advantageously the distance may be between 2 and 3 times this diameter.

10 Preferably the downstream edge of the last roller of the upper assembly is positioned directly above or downstream of the centre of the first roller of the lower assembly. This ensures that solids falling onto the lower assembly are conveyed efficiently away from their landing point.. Excessive overlapping
15 of the upper and lower assemblies wastes part of the length of the lower assembly.

The outer edge of the disc portions may be circular or may be the shape of a regular polygon such as a hexagon.

20 The construction of each of the roller assemblies may be substantially the same and the construction and spacing of each roller in an assembly may be substantially the same except for the location of the disc portions on adjacent rollers.

25 The size of the apertures in one or both assemblies may be the same.

According to another aspect of the invention there is provided a method of classifying heterogeneous solids comprising the following steps:

30 passing the solids over a first assembly of rollers drivingly rotated in a common direction about substantially parallel axes, each roller comprising a hub portion and a plurality of radially extending

disc portions which terminate adjacent the adjacent hub portion or portions,

dropping the solids passing off the first assembly of rollers, and

5 passing the solids, after dropping, over a second assembly of rollers having the features of the first assembly as defined above.

By way of example one form of apparatus for classifying heterogeneous solids and embodying the invention will now be described with reference to
10 the accompanying drawings, of which:

Figure 1 is a schematic elevation view of the apparatus, and

Figure 2 is a schematic plan view to a larger
15 scale of part of the apparatus.

Referring to Figure 1, the apparatus for classifying heterogeneous solids comprises a feed conveyer 1 having a belt 2 and an end roller 3, a first roller assembly 4 and a second lower roller assembly 5.

20 As can be seen from Figures 1 and 2 the upper roller assembly 4 comprises seven rollers 6 mounted for rotation about parallel axes each having a hub portion 7 and a plurality of disc portions 8 extending radially from the hub portion. In Figure 2, two of the rollers
25 6 are shown. The disc portions 8 which may be formed integrally or by welding annular disc members to the hub portion 7, terminate adjacent the adjacent roller or rollers and the location of the disc portions of one roller are staggered with respect to those of an adjacent
30 roller so that the disc portions of one roller intermesh with the disc portions of an adjacent roller to define apertures 9 between the rollers. Each of the rollers 6 is connected to a drive unit (not shown) which rotates



all the rollers 6 in a common direction indicated by the arrow 10 in Figure 1 and at a common speed.

The disc portions of the upper roller assembly 4 are shown in Figure 1 as having a circular outer edge.

The lower roller assembly 5 is of the same construction as the roller assembly 4 with one exception, namely that the disc portions of the lower roller assembly 5 are shown in Figure 1 as having a hexagonal outer edge. The rollers of the lower roller assembly 5 are driven by the same drive unit as the rollers of the upper roller assembly 4 and in the same direction as indicated by the arrow 11 in Figure 1.

The assemblies are positioned relative to one another such that the extreme downstream edge of the upper assembly 4 is vertically above the centre of the first roller of the lower assembly 5.

The position of the last roller of the upper assembly with respect to the first roller of the lower assembly is important for ensuring good mechanical conveying. If substantial material falls behind the centre of the first roller it tends to accumulate in this position since there is little forward driving power in this region. For the same reason the feed conveyor should similarly overhang the first roller of the upper assembly.

Positioning the assemblies with excessive overlapping wastes part of the length of the lower assembly.

In use heterogeneous solids, such as trade or domestic refuse is passed along the feed conveyor 1 and falls onto the right hand end of the upper roller assembly 4.

The rotating rollers carry the refuse across

the roller assembly to the left (as seen in Figure 1). During its passage across the roller assembly most of the materials smaller than the apertures 9 pass through the apertures while larger materials are carried over
5 the top of the roller assembly 4. Some smaller and less dense materials will also be carried across the upper roller assembly 4 on top of larger materials particularly if sheet-like larger materials are present.

10 As the partially classified refuse passes off the end of the roller assembly 4 it tumbles onto the lower roller assembly 5. This tumbling action serves to dislodge any smaller materials previously supported on larger materials. Thus as the refuse passes over
15 the roller assembly 5 nearly all the remaining materials smaller than the size of the apertures pass through the apertures.

In one particular example of the invention the principal dimensions of the apparatus were as follows:

20 height of roller 3 above roller assembly 4-
750 mm;

height of roller assembly 4 above roller
assembly 5-990 mm;

separation of centres of adjacent rollers -317
25 mm;

separation of hub portions of adjacent rollers
-152 mm;

separation of disc portion 8 of one roller
and hub portion 7 of adjacent roller -6 mm;

30 outer diameter of each disc portion in the upper
roller assembly 4 - 457 mm;

maximum dimension of each disc portion in the
lower roller assembly 5 - 457 mm;

separation of adjacent disc portions on one roller - 300 mm.

Tests conducted using this apparatus produced a marked improvement in separation efficiency over a similar apparatus having fourteen rollers on a single level. This apparatus is suitable for performing initial separation of refuse.

It should be understood that although one particular example of the invention has been described many modifications may be made. For example further roller assemblies may be added below the lower assembly 4. Also the shape of the disc portions may be changed and, in particular, the shape of the disc portions of the upper assembly may be the same as those of the lower assembly. If disc portions having a hexagonal outer edge are used, the rollers may be rotated at a slower rate than if disc portions having a circular outer edge are used since the hexagonal edge assists transfer of material across the rollers. With the roller assemblies described above it was found that rollers with circular disc portions when rotated at 85 r.p.m. produced similar results to the rollers with disc portions of hexagonal outline when rotated at 60 r.p.m. Other shapes such as oval, square or octagonal shapes may also be used for the disc portions. Also the disc portions may be knurled to assist transfer of material across the rollers.

Disc portions with non-circular outer edges produce better agitation of the solids but suffer from the disadvantage that they may pinch materials between a disc portion and an adjacent roller as the spacing between the disc portion and the adjacent roller changes. Since in embodiments of the present invention

refuse tumbles between the first and second roller assemblies the importance of agitation of the refuse during its passage over either assembly is greatly reduced and therefore disc portions having circular outer edges may be used.

The rollers may be made by mounting annular rollers and discs alternately on a common shaft and clamping them together. This construction enables easy replacement of damaged discs and also allows the size of the apertures in the roller assembly to be varied.

The height of the upper roller assembly above the lower roller assembly can be varied. It is considered that a height of between two and three times the diameter of the rollers is preferable since this gives an adequate distance for the solids to tumble but does not take up too much space. The distance must be sufficient to allow solids on top of sheet-like solids to fall off the sheet-like solids.

In the described embodiment only three disc portions are shown on each roller. In a commercial application where larger quantities of solids are to be separated the width of each roller would be increased and the number of disc portions on each roller correspondingly increased: for example six disc portions might be provided on each roller.

In certain applications it may be desirable for the size of the apertures formed between adjacent discs and adjacent rollers to vary between one roller assembly and another or along one roller assembly. Also the speed of rotation of the rollers may increase with distance downstream of the feed-point.

It should also be understood that the solids

- being classified need not pass directly from the end of the upper assembly onto the lower assembly, they may alternatively pass from the upper assembly onto a conveyor belt and then onto the lower assembly,
- 5 the dropping of the solids occurring between the conveyor belt and one of the lower or upper assemblies.

What we claim is:

1. An apparatus for classifying heterogeneous solids comprising a first assembly of rollers (4) mounted for rotation about substantially parallel axes, each roller (6) comprising a hub portion (7) and a plurality of radially extending disc portions (8), the disc portions of each roller intermeshing with those of the or each adjacent roller and terminating adjacent the or each adjacent roller to define apertures (9) therebetween, and drive means for rotating the rollers in a common direction, characterised in that a second assembly of rollers (5) is provided having the features of the first assembly (4) as defined above, the arrangement being such that in use solids passing over the first assembly (4) fall from the downstream end of the first assembly onto the upstream end of the second assembly (5).
2. An apparatus as claimed in claim 1 further characterised in that the space between the first and second assemblies (4,5) through which in use the solids fall is unobstructed so that the fall of the solids is a free fall.
3. An apparatus as claimed in claim 1 or 2 further characterised in that the arrangement is such that, in use, the solids fall through a distance greater than the outer diameter of the disc portions (8) of the rollers (4,5).
4. An apparatus as claimed in claim 3 further characterised in that the distance is between 2 and 3 times the outer diameter of the disc portions (8) of the rollers (4,5).

5. An apparatus as claimed in any preceding claim further characterised in that the downstream edge of the last roller (6) of the first assembly (4) is positioned directly above or downstream of the centre of the first roller (6) of the second assembly (5).
6. An apparatus as claimed in any preceding claim further characterised in that the outer edge of each disc portion (8) is circular.
7. An apparatus as claimed in any of claims 1 to 5 further characterised in that the outer edge of each disc portion (8) is the shape of a regular polygon.
8. An apparatus as claimed in any preceding claim further characterised in that the construction and spacing of each roller (6) in an assembly is substantially the same except for the location of the disc portions (8) on adjacent rollers.
9. An apparatus as claimed in any preceding claim further characterised in that the construction of the first and second roller assemblies (4,5) is substantially the same.
10. A method of classifying heterogeneous solids including the step of:
- passing the solids over a first assembly of rollers (4) drivingly rotated in a common direction about substantially parallel axes, each roller (6) comprising a hub portion and a plurality of radially extending disc portions (8) which terminate adjacent the adjacent hub portion or portions,
- characterised in that the method includes the following steps:
- dropping the solids passing off the first assembly of rollers (4), and

passing the solids, after dropping, over a second assembly of rollers (5) having the features of the first assembly (4) as defined above.

11. A method as claimed in claim 10 further characterised in that the dropping step consists of dropping the solids through a distance greater than the outer diameter of the disc portions (8) of the rollers (6).

12. A method as claimed in claim 11 further characterised the distance is between 2 and 3 times the outer diameter of the disc portions (8) of the rollers (6).

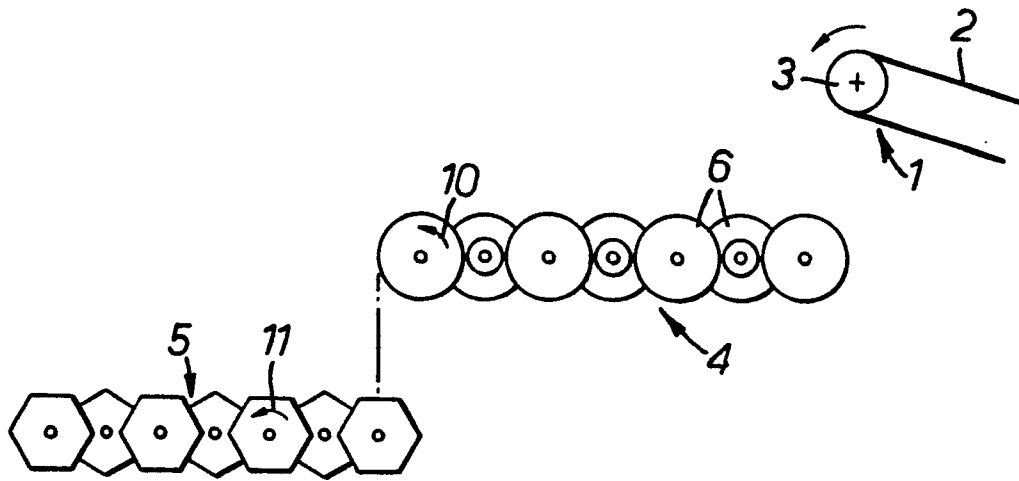


FIG. 1.

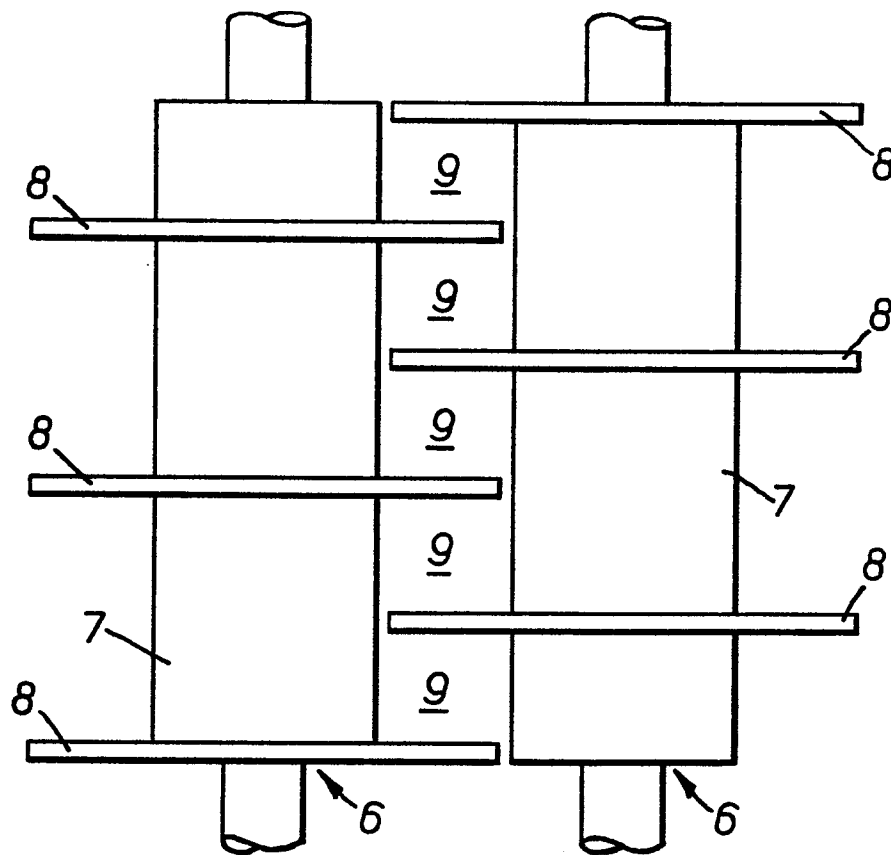


FIG. 2.



DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	<u>GB - A - 1 177 769 (ZEMANEK)</u> * Page 2, lines 47-87; figures 1,2 *	1,2,3, 5,6,7, 8,10	B 07 B 1/15
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	<u>GB - A - 448 838 (KRUPP)</u> * Page 1, lines 10-31; from page 1, line 95 to page 2, line 3, figure 1 *	1,2,3, 5,7,8, 9,10, 11	
	--		TECHNICAL FIELDS SEARCHED (Int.Cl.)
	<u>GB - A - 1 087 921 (ALLEN)</u> * Page 2, lines 35-64; figures 1,2,5 *	7,8	B 07 B B 03 B 9/00
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	<u>GB - A - 518 330 (SIMON CARVES LTD. et al.)</u> * Page 1, lines 64-76; page 2, lines 34-39; figures 1,2 *	6,8	
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			X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
			&: member of the same patent family, corresponding document
b	The present search report has been drawn up for all claims		
Place of search	Date of completion of the search	Examiner	
The Hague	08-12-1978	LAPEYRONNIE	