

ASSIGNEE - APPLICANT

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952

DECLARATION IN SUPPORT OF AN APPLICATION FOR A PATENT

In support of an Application made by: FORMARK PTY. LIMITED

for a patent for an invention entitled: "SHREDDER"

*Tullamarine  
address*  
I, COLIN JOSEPH HICKEY  
of, 108 Mountview Ave, Hazelbrook, New South Wales, Australia

do solemnly and sincerely declare as follows:

1. I am authorised by the above mentioned applicant for the patent to make this Declaration on its behalf.
2. The name and address of each actual inventor of the invention is as follows:  
*formerly*  
Colin Joseph HICKEY of 11 Valda Street, Blacktown, New South Wales, 2148, Australia *and now of* 108 Mount View Ave, Hazelbrook, NSW, Australia.  
and  
Max Ronald RAJEWSKI of 11859 Cresta Verde Drive, Whittier, Los Angeles, California, U.S.A.

and the fact(s) upon which the applicant is entitled to make this application are as follows:

Max Ronald RAJEWSKI and Colin Joseph HICKEY have assigned their rights to the invention to FORMARK PTY. LIMITED by an assignment dated 12 November 1987.

3. The basic application as defined by Section 141 of the Act was made as in AUSTRALIA on 6 May 1987 in the names Colin Joseph HICKEY and Max Ronald RAJEWSKI
4. The basic application referred to in the preceding paragraph of this Declaration was the first application made in a Convention country in respect of the invention the subject of this application.

Declared at Sydney this 18th day of December 1987.

Signed: \_\_\_\_\_

Position: \_\_\_\_\_

GRIFFITH HACK & CO.  
SYDNEY, AUSTRALIA

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**(12) PATENT ABRIDGMENT      (11) Document No. AU-B-17226/88**  
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(54) Title  
SHREDDER

International Patent Classification(s)  
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(56) Prior Art Documents  
AU 42479/78

(57) Claim

1. A shredder for shredding bulk waste paper cardboard, packaging material, microfilm, microfiche and other sheet material, which comprises

a receiving hopper for receiving material to be shredded which is rotatably mounted for rotation about an upstanding axis, and having a stationary floor;

a rotary hammer-mill disposed below the hopper floor and protruding into the hopper for shredding material in the hopper, the hammer-mill comprising a plurality of flails loosely mounted to the circumference of a body rotatably mounted about a generally transverse axis;

a set of fingers interdigitated with the flails and mounted on the stationary hopper floor on the side of the hammer-mill where rotation of the mill tends to force material downwardly out of the hopper;  
a perforated screen partially enclosing the

(11) AU-B-17226/88  
(10) 603676

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hammer-mill below the hopper floor and through which the shredded material passes when it has reached a chosen level of comminution;  
reciprocating bailer means disposed in a duct arranged to receive the shredded material from the screen and to compact the shredded material, before discharging it from the duct past a non-return flap hingedly mounted at an outlet from the duct; and  
drive means arranged to drive the rotatable hopper, rotary hammer-mill and reciprocating bailer.

AUSTRALIA (51)  
PATENT PCT

(43) 6.12.88

AU-A-17226/88

WORLD INTELLECTUAL PROPERTY ORGANIZATION  
International Bureau

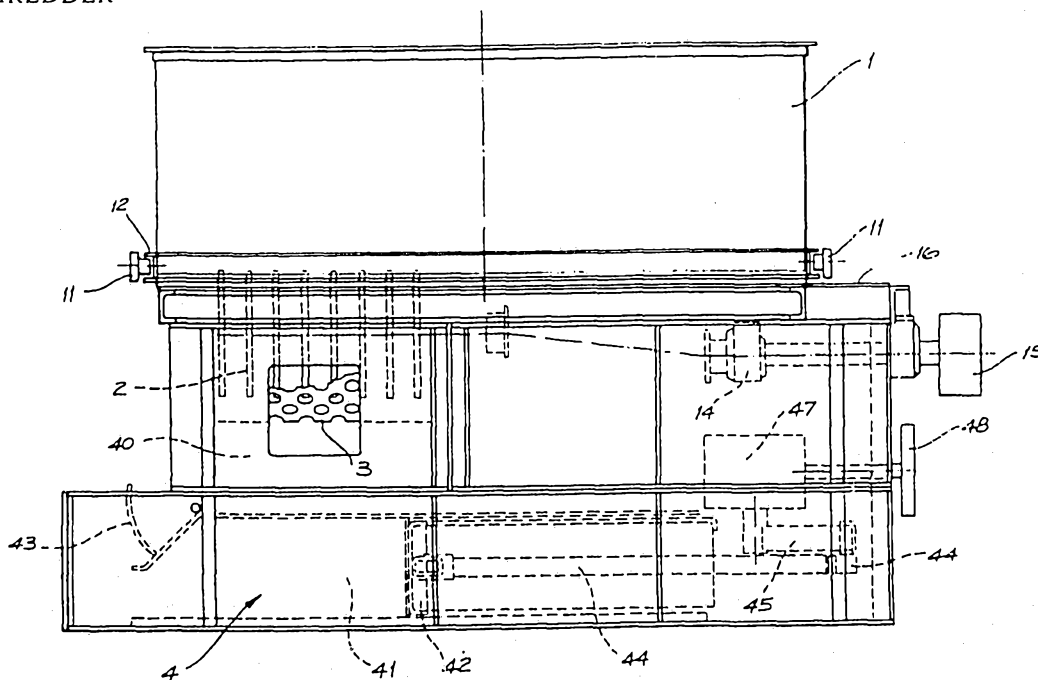


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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <b>(51) International Patent Classification 4 :</b><br>B02C 13/04, 13/13, 18/14<br>B02C 18/44                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  | <b>A1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>(11) International Publication Number:</b> WO 88/ 08750<br><b>(43) International Publication Date:</b> 17 November 1988 (17.11.88) |
| <b>(21) International Application Number:</b> PCT/AU88/00135<br><b>(22) International Filing Date:</b> 6 May 1988 (06.05.88)<br><b>(31) Priority Application Number:</b> PI 1756<br><b>(32) Priority Date:</b> 6 May 1987 (06.05.87)<br><b>(33) Priority Country:</b> AU<br><br><b>(71) Applicant (for all designated States except US):</b> FOR-MARK PTY. LIMITED [AU/AU]; 3-5 Seville Street, Villawood, NSW 2163 (AU).<br><br><b>(72) Inventors; and</b><br><b>(75) Inventors/Applicants (for US only):</b> HICKEY, Colin, Joseph [AU/AU]; 11 Valda Street, Blacktown, NSW 2148 (AU). RAJEWSKI, Max, Ronald [US/US]; 11859 Cresta Verde Drive, Whittier, Los Angeles, CA 90000 (US). |  | <b>(74) Agent:</b> GRIFFITH HASSEL & FRAZER; G.P.O. Box 4164, Sydney, NSW 2001 (AU).<br><br><b>(81) Designated States:</b> AT (European patent), AU, BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent), US.<br><br><b>Published</b><br>With international search report.<br><br><b>A.O.J.P. 27 JAN 1989</b><br><br><div style="border: 1px solid black; padding: 5px; text-align: center;">AUSTRALIAN<br/>- 6 DEC 1988<br/>PATENT OFFICE</div> |                                                                                                                                       |

**(54) Title:** SHREDDER



**(57) Abstract**

A shredder for bulk waste paper etc. comprises a rotatable hopper, a rotary hammer-mill (2) comprising a plurality of flails (24), a set of fingers (30) interdigitated with the flails in the floor of the hopper, a perforated screen (3) enclosing the lower part of the hammer-mill, a reciprocating bailer (42) for compacting and discharging shredded material and a drive means (15, 48).

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"SHREDDER"Technical Field

5 The present invention relates to a shredder for shredding waste paper, cardboard, packaging materials and other sheet media such as microfilm and microfiche. The construction is particularly adapted for large scale bulk industrial use, and may be transported for on-site use.

Prior Art

10 Shredders for small scale use are already known and these generally comprise two sets of intermeshed counter-rotating wheels, into the nip of which the sheet of paper to be shredded is fed. Such shredders are generally able to cope with a single sheet or at the most a small number of sheets of paper at one time. Moreover, such  
15 shredders often have problems in dealing with staples, paper clips, and other metal commonly associated with documents. Such a construction is quite unable to cope when there are large amounts (for example, tonnes) of waste material to be shredded.

20 A number of shredders are known from prior art patent specifications. U.S. 3 967 785 discloses an apparatus for defibrating cellulose having a rotatable hopper and a milling cutter. U.S. 2 650 745, 3 483 906 and 3 615 059 disclose similar apparatus for grinding agricultural  
25 feedstuff. U.S. 4 412 659 describes a mill for shredding waste material having an adjustable grate for progressively feeding the material to the shredding wheel. DE 27 90 582 discloses the use of a hammer-mill to shred paper.

30 Objects

The object of the present invention is to provide a shredder which is capable of shredding waste material with high throughput and of handling a mixture of different  
35 such materials randomly fed into the shredder. The shredder is intended to be able to cope with a wide variety of office waste paper, documents and other recording media, particularly that of a confidential or secret classification. For such an application it may be



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desirable to have the shredder mounted on a truck or trailer to allow it to shred such materials on-site so that the customer can satisfy himself that the material has indeed been safely disposed of. The invention thus also seeks to provide a transportable construction, which in addition enables the shredded waste to be reasonably compacted to minimise the volume of shredded material which must be taken away again.

#### Summary of the Invention

The present invention provides a shredder for shredding bulk waste paper cardboard, packaging material, microfilm, microfiche and other sheet material, which comprises

a receiving hopper for receiving material to be shredded which is rotatably mounted for rotation about an upstanding axis, and having a stationary floor;

a rotary hammer-mill disposed below the hopper floor and protruding into the hopper for shredding material in the hopper, the hammer-mill comprising a plurality of flails loosely mounted to the circumference of a body rotatably mounted about a generally transverse axis;

a set of fingers interdigitated with the flails and mounted on the stationary hopper floor on the side of the hammer-mill where rotation of the mill tends to force material downwardly out of the hopper;

a perforated screen partially enclosing the hammer-mill below the hopper floor and through which the shredded material passes when it has reached a chosen level of comminution;

reciprocating bailer means disposed in a duct arranged to receive the shredded material from the screen and to compact the shredded material, before discharging it from the duct past a non-return flap hingedly mounted at an outlet from the duct; and drive means arranged to drive the rotatable hopper,

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rotary hammer-mill and reciprocating bailer.

It has been found preferable to use a rotating hopper, which is circular in plan-view. The hopper is located above the hammer-mill, and the hammer-mill is preferably eccentrically located so that rotation of the hopper feeds material progressively over the hammer-mill. Usually, the hopper includes a paddle extending across it to feed the material to be shredded over the hammer-mill. In one construction, both the paddle and the walls of the hopper rotate together and this is found to be particularly advantageous. Alternatively, only the paddle is rotated.

The hammer-mill is arranged so that its upper portion protrudes into the receiving hopper so that as the hopper brings material over the hammer-mill it shaves off only a predetermined amount, thereby preventing clogging and overloading of the mill.

It has also been found to be necessary to provide fingers in the base of the receiving hopper, and which are interdigitated with the flails on the hammer-mill. Thus there is included a first set of fingers on the side of the mill where the material to be shredded is passed away from the receiving hopper, since this presents the material to the flails in an appropriate manner and also prevents clogging of material between the hammer-mill and the screen. It has also been found advantageous to provide a deflector plate or second set of fingers on the other side of the hammer-mill to help prevent partially shredded material from being flung out of the hammer-mill into the hopper again. This causes the partially shredded material to be carried around with the hammer-mill through the hopper and back past the first set of fingers.

The rotary hammer-mill can be of conventional construction and preferably comprises four or six series of flails loosely mounted to longitudinally extending rods interconnected by spaced plates constituting the body of the mill. The spaced plates allow each flail to move a

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predetermined extent in a longitudinal direction and also to a certain extent in a circumferential direction. The flails are loosely mounted to the rotatable body of the hammer-mill to allow the flails to ride over any particularly hard material, so preventing their breakage, and allowing the shredder to handle a wide variety of materials. Rigidly mounted flails tend to break off easily. The hammer-mill is rotated at, for example 1,000 to 3,000 RPM, by any suitable rotary drive means, such as a hydraulic motor, an electric motor or an internal combustion engine.

The purpose of the perforated screen is to contain the partially shredded material around the hammer-mill until it becomes small enough to pass through the perforations in the screen and be discharged from the shredder. Usually, the screen will extend all around the hammer-mill except for the portion of the hammer-mill projecting into the receiving hopper. The size of the perforations in the screen can be varied according to the degree of shredding desired. Generally, the clearance of the screen from the hammer-mill will be greatest adjacent the receiving hopper and least on the opposite side to the hopper.

A discharge means is provided for removing the shredded material. It is particularly envisaged that the shredder of the present invention shall be mobile and mounted on a truck for on-site shredding of bulk material. Thus, it is desirable to use a discharge means which not only removes the shredded material from the outlet of the shredder but also compacts it into a storage bin provided on the truck. It has been found to be particularly advantageous to use a reciprocating pusher (in the manner of an agricultural bailer) to push out the shredded material. Surprisingly, it has been found that this also provides a considerable degree of compaction. The bailer generally comprises a duct in which the pusher reciprocates, and into which shredded material is fed. It

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has been found necessary to provide a flap on the outlet of the duct, so as to reduce the rush of air into the duct as the reciprocating pusher withdraws which otherwise blows the shredded material back towards the screen.

5     Description of Preferred Embodiment

An embodiment of the invention will now be described with reference to the drawings wherein:

Figure 1 is a schematic cross-sectional elevation of a shredder according to the invention;

10     Figure 2 is a side view; and

Figure 3 is a plan view of the shredder.

The shredder comprises a receiving hopper 1 rotatably mounted above a stationary floor 16 on which is mounted a hammer-mill 2 surrounded by a screen 3, and discharge  
15     means 4.

The receiving hopper 1 is of circular cross-section and includes a paddle 10 which rotates therewith. The hopper 1 is rotatably mounted on wheels 11 which run along a track 12. The shredder has a body 13. The hopper is  
20     circumferentially driven by a tire 14 and associated drive means 15. Alternative wheels 11 can be driven, or a separate drive wheel applied to track 12.

The hammer-mill 2 is rotatably mounted on a shaft 20 running in bearings 21 and 22 and driven by drive means  
25     15. The rotatable body is comprised of six parallel rods, 23 held together by a series of spaced plates 25 mounted on the shaft 20. Flails 24 are loosely retained on the pins 23 between the spaced plates 25. The flails are formed of spring steel and are floating along and around  
30     the pins. The upper end of the hammer-mill 2 extends (for example, about 6 inches (about 15 cm)) upwards into the hopper.

The screen 3 surrounds the lower end of the hammer-mill which does not extend into the hopper. At its lower  
35     end, the screen is spaced approximately a quarter of an inch (about 6 mm) from the flails, and spaced about 2 inches (about 5 cm) from the flails at its upper ends. The size of the perforations may be varied depending on the

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nature of the material being shredded. For use on material consisting predominantly of paper oval perforations 15 to 20 mm wide and 40 mm long are preferred. For microfiche the perforations are preferably

5 5 mm wide and 10 mm long.

As shown in Figure 3, a set of fingers 30 and a deflector plate 32 having ribs 31 on a underside thereof are provided in the base of the hopper.

Beneath the screen 3 is an outlet 40 leading to a transverse duct 41 in which is reciprocatingly located a pusher 42 of a bailer-discharger. The pusher is operated by a rod 44 reciprocated by an eccentric 45 driven via gearbox 47 from drive cog 48. Typically the shredded material is compacted to a quarter of its original volume.

10

15 On the outlet of the duct is a rubber flap 43 which is hinged at its upper end.

The shredder may be operated as follows. Material to be shredded, for example boxes of documents, is thrown into the top of the receiving hopper. The rotating hopper carries the material over the set of fingers 30 and onto the hammer-mill, where the paper is partially shredded and passed into the space between the hammer-mill and the perforated screen, where it is comminuted to a size small enough to pass through the perforations in the screen.

20

25 Any material which passes out of the hammer-mill is deflected by plate 32 back onto the mill and is carried round past fingers 30 again. Any material remaining in the hopper continues to rotate until it comes over the hammer-mill once again and a further layer is "shaved-off".

30 Shredded sized material falls downwards through the screen into the outlet 40, where it remains until the bailer is retracted and it falls into the duct 41. Typically, the bailer-discharger reciprocates about 50 times per minute, compacts and discharges material out of the duct into a storage compartment (not shown), at the

35 same time compacting it. When the shredder is mounted on a truck, the storage compartment typically contains 7 to 8 tonnes of shredded material.

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THE CLAIMS

1. A shredder for shredding bulk waste paper cardboard, packaging material, microfilm, microfiche and other sheet material, which comprises

- 5           a receiving hopper for receiving material to be shredded which is rotatably mounted for rotation about an upstanding axis, and having a stationary floor;
- 10           a rotary hammer-mill disposed below the hopper floor and protruding into the hopper for shredding material in the hopper, the hammer-mill comprising a plurality of flails loosely mounted to the circumference of a body rotatably mounted about a generally transverse axis;
- 15           a set of fingers interdigitated with the flails and mounted on the stationary hopper floor on the side of the hammer-mill where rotation of the mill tends to force material downwardly out of the hopper;
- 20           a perforated screen partially enclosing the hammer-mill below the hopper floor and through which the shredded material passes when it has reached a chosen level of comminution;
- 25           reciprocating bailer means disposed in a duct arranged to receive the shredded material from the screen and to compact the shredded material, before discharging it from the duct past a non-return flap hingedly mounted at an outlet from the duct; and
- 30           drive means arranged to drive the rotatable hopper, rotary hammer-mill and reciprocating bailer.

35           2. A shredder according to claim 1 wherein the receiving hopper further comprises paddle means mounted thereto and rotatable therewith for rotating the material to be shredded.

          3. A shredder according to claim 1 wherein the hammer-mill is located eccentrically of the hopper and to one side of the upstanding axis.

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4. A shredder according to claim 1 wherein the hammer-mill rotatable body comprises a plurality of rods to which the flails are loosely attached mounted in a parallel array around a central driven shaft.

5

5. A shredder according to claim 1 which further comprises a deflector plate mounted on the stationary floor and closely approaching the hammer-mill at a side opposite the set of fingers, to help prevent shredded material being deposited back into the hopper.

10

6. A shredder according to claim 1 wherein there is a clearance between the hammer-mill and the screen, which is greatest adjacent the hopper and least at a lower side of the screen.

15

7. A shredder according to claim 1 wherein the bailer comprises a reciprocating plunger located in the duct, which withdraws to allow shredded material to fall into the space in the duct between the plunger and the non-return flap, and which extends to compact the material and discharge it past the flap.

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8. A shredder according to claim 1 which is further provided with transportation means allowing the shredder to be transported for use on-site.

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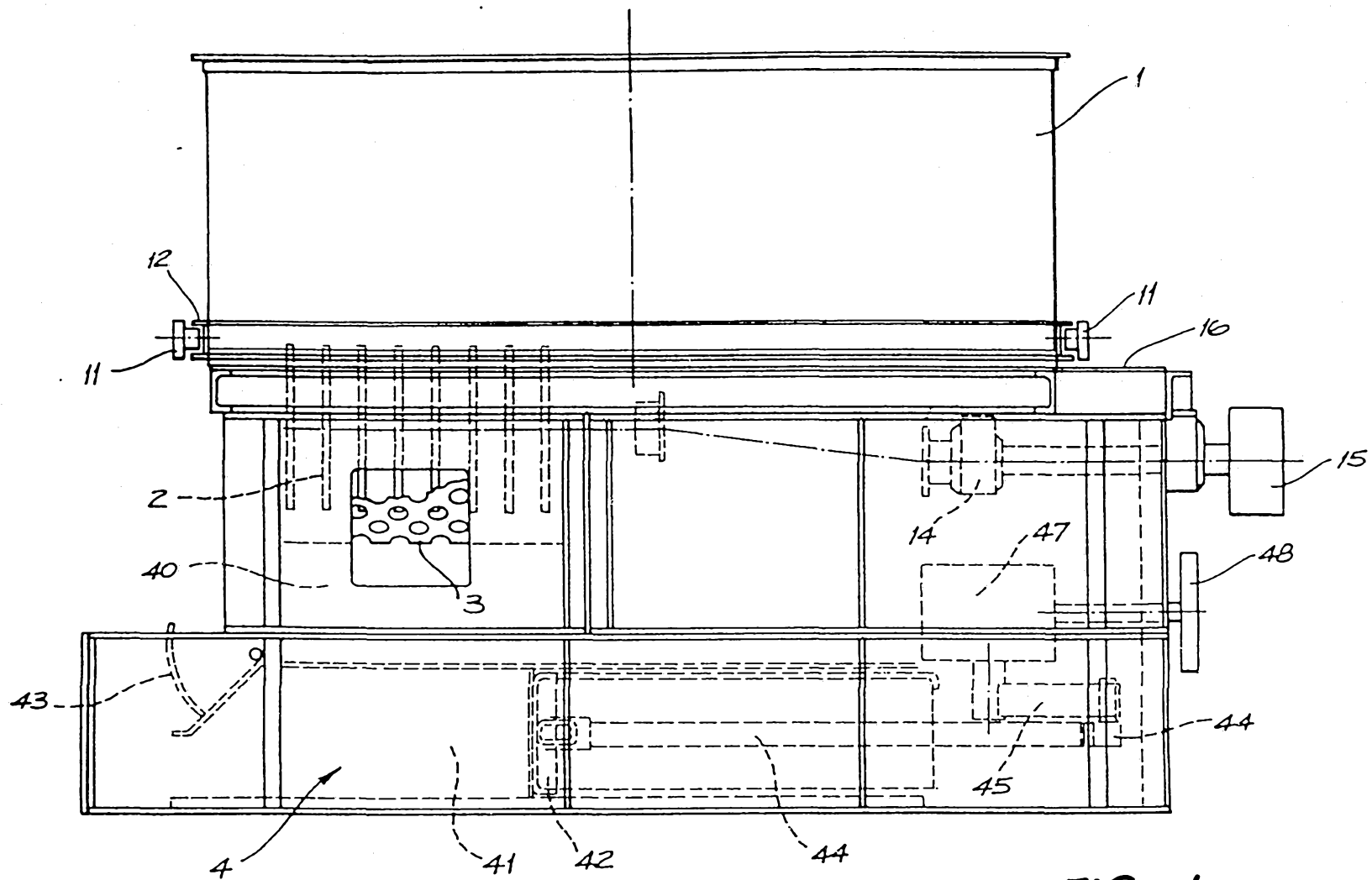


FIG. 1

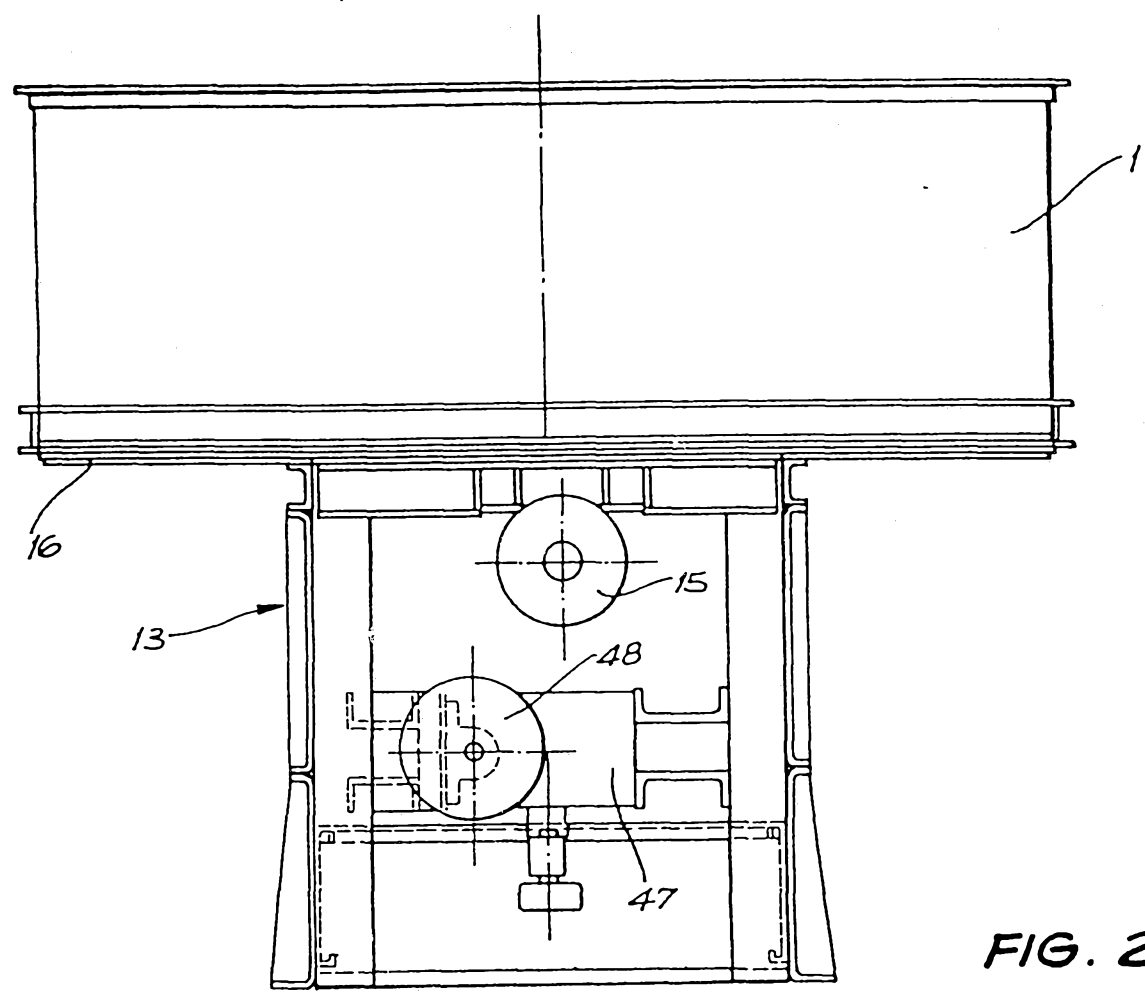


FIG. 2

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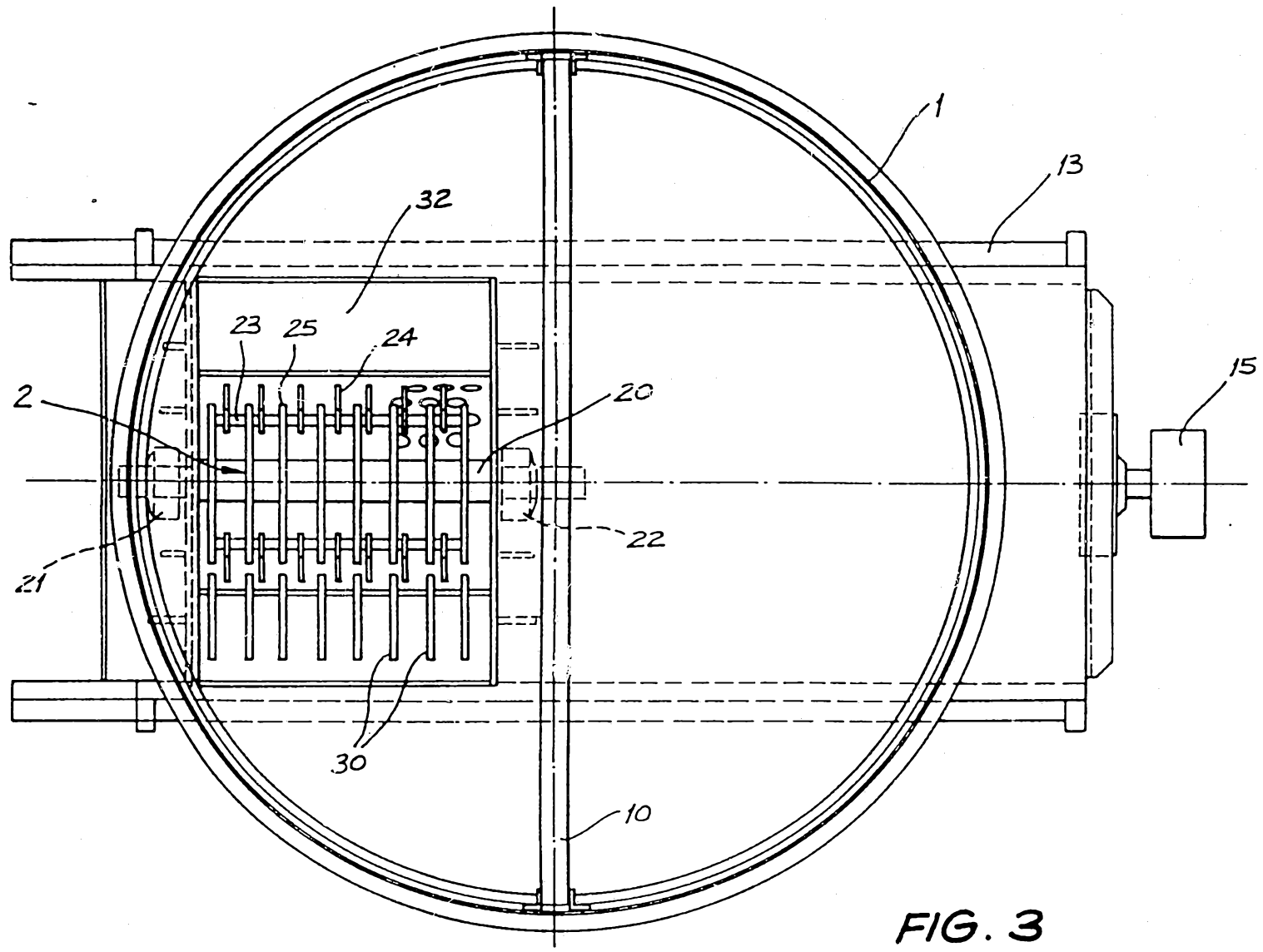


FIG. 3

# INTERNATIONAL SEARCH REPORT

International Application No.

PCT/AU 88/00135

## I. CLASSIFICATION OF SUBJECT MATTER : (Several classification symbols apply, indicate all)

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl.<sup>4</sup> B02C 13/04, 13/13, 18/14, 18/44

## II. FIELDS SEARCHED

Minimum Documentation Searched \*

Classification System

Classification Symbols

IPC B02C 13/04, 13/13, 18/14, 18/44

Documentation Searched other than Minimum Documentation  
to the Extent that such Documents are Included in the Fields Searched \*

AU : IPC as above

## III. DOCUMENTS CONSIDERED TO BE RELEVANT \*

Category \* 1 Citation of Document, \*\* with indication, where appropriate, of the relevant passages \*\* Relevant to Claim No. \*\*

- |   |                                                                                                                           |  |
|---|---------------------------------------------------------------------------------------------------------------------------|--|
| A | AU,B, 17731/56(220638)(M.F. STEEL WASHERS PTY LTD)<br>24 October 1957 (24.10.57)                                          |  |
| A | CH,A, 251305(ARNOLD SIGG) 2 August 1948 (02.08.48)                                                                        |  |
| A | FR,A,998844(CHARLES PETROD) 23 January 1952 (23.01.52)                                                                    |  |
| A | Derwent Abstract Accession no. J6798C/40, Class P12,<br>SU,A, 716589 (TSELINA AGRIC MECHN) 25 February 1980<br>(25.02.80) |  |
| A | US,A, 2650745 (OBERWORTMAN) 1 September 1953 (01.09.53)                                                                   |  |
| A | US,A, 3967785 (GROSCH) 6 July 1976 (06.07.76)                                                                             |  |
| A | US,A, 4412659 (CRAWFORD et al) 1 November 1983<br>(01.11.83)                                                              |  |

\* Special categories of cited documents: \*\*

-A- document defining the general state of the art which is not considered to be of particular relevance

-E- earlier document but published on or after the international filing date

-L- document which may throw doubt on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

-O- document referring to an oral disclosure, use, exhibition or other means

-P- document published prior to the international filing date but later than the priority date claimed

-T- later document published 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

-X- document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

-Y- document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

-A- document member of the same patent family

## IV. CERTIFICATION

Date of the Actual Completion of the International Search

22 August 1988 (22.08.88)

Date of Mailing of this International Search Report

(29.08.88) 29 AUGUST 1988

International Searching Authority

AUSTRALIAN PATENT OFFICE

Signature of Authorized Officer

R.W. Allan for :  
R.B. CAMPBELL

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON  
INTERNATIONAL APPLICATION NO. PCT/AU 88/00135

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

| Patent Document<br>Cited in Search<br>Report |         | Patent Family Members |         |    |         |
|----------------------------------------------|---------|-----------------------|---------|----|---------|
| US                                           | 3967785 | CA                    | 1044501 | CH | 616090  |
|                                              |         | DK                    | 555/76  | ES | 445122  |
|                                              |         | FR                    | 2300842 | IT | 1053834 |
|                                              |         | SE                    | 7601320 | DE | 2605604 |
|                                              |         |                       |         | ES | 458717  |
|                                              |         |                       |         | NL | 7601171 |

END OF ANNEX