**Title:** A GEAR ASSEMBLY

A self braking reduction gear assembly which utilizes two planetary gear systems (7, 8) each of which in turn meshes with a dedicated gear (2, 9), respectively. Input shaft (3) rotation directly rotates the first planetary gear system (7) and the rotation of the individual gears (7) thereof cause a corresponding rotation of the individual gears (8) of the second planetary gear system (8). For self braking the dedicated gears (2, 9) preferably have the same pitch circles but different teeth numbers.
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A GEAR ASSEMBLY

TECHNICAL FIELD

The present invention relates to a novel gear assembly and methods in uses thereof.

Many forms of gear assembly are known which enable higher speed rotational input to be reduced through a gear train to provide a lower rotational speed but at greater torque. The present invention relates to such a gear assembly such as might be useful in converting a manual or electric motor rotational input into a higher torque rotational drive for diverse purposes including, for example, the raising and lowering of doors, the winching of sheets on a yacht, the winching of ropes or cables for any purpose whatsoever, etc.

The present invention is unrestricted as to the use to which the gear assembly of the present invention is directed but it is an object of the present invention to provide a gear assembly (preferably without any sun gear) which through related planetary gears can provide for self braking (or almost self braking) in certain embodiments (although not necessarily so) and/or allows for a speed reduction with a torque increase.

As used herein the term "self braking" means no more than the ability to resist the transmission of movement back through the assembly from the output side.

DISCLOSURE OF INVENTION

In a first aspect the invention consists in a gear assembly comprising input means providing or to provide, or through which can be provided, a rotational input;

means providing a first plurality of planetary axes about and parallel to the rotational axis of said input means, said planetary axes to rotate as a group about said rotational axis of said input means as and when said input means rotates,

means providing a second plurality of planetary axes about and parallel to the rotational axis of said input means,

a first set of gears, one mounted on each planetary axis of said first plurality of planetary axes,

a second set of gears, one mounted on each planetary axis of said second plurality of planetary axes,

a first internal gear with which said first set of gears mesh, and

output means rotatable about an axis at least parallel to the rotational axis of said input means, said output means having directly or indirectly a second internal gear with which said second set of gears mesh,
wherein said first plurality of planetary axes are in a fixed relationship with said second plurality of planetary axes,

and wherein the pitch circle of said first and second internal gears is at least substantially the same (preferably the same for self braking),

and wherein (preferably when the said pitch circles are the same) there is a disparity in teeth (or the equivalent meshing elements) numbers between said first and second internal gears.

Preferably said input means provides without a sun gear for the rotation of said first set of planetary axes.

Preferably said input means is a shaft (eg. of a motor). Preferably the gear assembly is self braking and is a reduction gearing. Preferably each axis of said first set of axes is coincident with an axis of the second set of axes. Preferably each gear of said first set is attached to or integral with a gear of said second set.

Preferably one only of said integral or merged first and second gears has an aligned teeth structure to mesh with both said first and second internal gears, ie. preferably the gears otherwise (as between the first and second set pairings) are out of phase.

Preferably the gears of each planetary set have the same teeth numbers. Preferably said planetary mounted first and second sets of gears are substantially encased in a cage or housing.

Preferably the means providing said first and second sets of planetary axes are in the form of a spider or spiders or the equivalent fixed to said input means (eg. not necessarily a cage or housing).

Preferably said first internal gear forms part of a fitting to an electric motor of which the shaft (or some drive therefrom (hereafter “shaft”) is said input means (ie. preferably said first internal gear is reactive to said input means).

Preferably said first internal gear is adapted to be disengaged from the shaft of said input means or said output means to the extent that when desired it can idle relative thereto, eg; if for a garage door to allow manual operation thereof.

Preferably said output means is a wheel, roller, capstan, pulley, winch drum, sprocket or an external or other form of gear (ie; worm, spur, or other).

Preferably the disparity in teeth is by an integer of from 1 to 5. (Preferably 1 to 4 and most preferably 1).
Preferably that internal gear having the fewer teeth is the input internal gear. If the input internal gear has 'X' teeth and the output internal gear has ‘X’ + 1, the reduction of the gear assembly will be 'X' to 1.

In a further aspect the invention consists in a self braking reduction gear assembly, the assembly having input rotational means and output rotation means,

wherein the input means through a plurality of planetary gears (planetary of the rotational axis of the input means only and preferably not of any 'sun' gear), each running on the same internal gear of pitch circle diameter "A" and of teeth number "X", rotates a plurality of planetary gears (also planetary of the rotational axis of said input means) which in turn rotate an output internal gear of pitch circle of diameter "A" (or near "A") and of teeth numbers "X" ± "∝", where ∝ is a small integer or zero (but preferably is at least one) of the output means,

and wherein input via the output means does not correspondingly provide any output via the input means.

Preferably the internal gear of the output means is of teeth number "X"−"∝".

In still a further aspect the invention consists in a method of transferring a rotational input at input means at increased torque to output means, said method comprising

(preferably without the use of a sun gear) rotating planetary idling gears by meshing each with an internal gear as the axis of each idling gear rotates planet-like about a rotational input axis defined by means which causes the planetary movement of the idling gear axes, and

using each idling gear to drive directly or indirectly a planetary gear of a second set of planetary gears (that are planetary with respect to the input axis) such that the second set of planetary gears mesh engage with and drive the rotation of an internal gear (directly or indirectly) of output means.

Preferably the mechanism is self braking.

Preferably each internal gear is of substantially the same pitch circle and preferably the teeth numbers on each internal gear differs.

Preferably each planetary gear (set to set) is of substantially the same pitch diameter.

Preferably some at least of the second set of planetary gears have teeth offset from those of the first set to accommodate a teeth number difference in said two internal gears.

Alternatively the pitch circles may be almost the same (preferably the planetary gears being adjusted accordingly to provide at least "near" self braking).
BRIEF DESCRIPTION OF DRAWINGS

Preferred forms of the present invention will now be described with reference to the accompanying drawings in which;

Figure 1 is an exploded view of an electric motor including assembly in accordance with the present invention, the drawing showing to the right an electric motor assembly having a rotatable input shaft onto which is keyed or splined (or otherwise associated), a cage, mount, spider or the like for the related two planetary gear systems of the present invention, that ("input") series of planetary gears to the right being those to mesh in the internal gear of the housing of the electric motor shown to the right while those ("output") planetary gears to the left (each to rotate directly as its corresponding "input" planetary gear rotates) is adapted to mesh within and drive the rotation of an internal gear of the output means;

Figure 2A is a side assembly of the arrangement shown in Figure 1 showing in cross-section the important aspects of the gear assembly but not showing the electric motor nor any mount or input shaft therefrom in section;

Figure 2B is a side elevation of the arrangement of Figure 2A;

Figure 3 is a plan view of one embodiment which provides a cage or housing which provides three (by way of example - there could, for example, be six) axles within the housing each supporting both an input and an output planetary gear, the gears preferably being moulded as a single component, the view showing how the housing can be provided with a profile which allows it to receive a dogged, keyed, splined or other drive from the output shaft of, for example, an electric motor or, for that matter, from a hand cranked input shaft as might be the case with a winch;

Figure 4 is a diagrammatic view of the relationship of a plurality of three input planetary gears with their input side internal gear and a corresponding arrangement of a plurality of three output planetary gears with their output internal gear, Figure 4 showing an arrangement where there is a slight discrepancy in both (i) the teeth numbers (the input side, for example, having 36 and the output side, for example, 37) and (ii) the pitch circles A and B of the input and output internal gears respectively;

Figure 5 is a more preferred arrangement to that of Figure 4 where the pitch circle diameter A' corresponds exactly to that of B' and preferably there are corresponding pitch circle diameters for the two sets of planetary gears (whatever their number of gears - preferably the same for each set) ie. pitch circle diameter C' equals pitch circle diameter D', such an arrangement ensuring the best possible self braking where preferably there is a discrepancy of at least one in the tooth numbers between the input and output sides (eg. 36 teeth are on pitch circle A' and 37 teeth are on pitch circle B');
Figure 6 is a diagrammatic view looking along the plane of a sectional door showing how the edgewise rollers thereof (preferably located at or parallel to the pivot axis between sections) can be guided reproducibly in a known manner in a known side track for such doors, Figure 6 however showing how such a guide track can include a further channel (preferably open in the same direction as is the roller or wheel tracking channel for the sectional door) which includes there within a flexible or deformable rack preferably as hereinafter described capable of being moved along the track under the action of the output gear shown (which preferably is as shown in Figures 1, 2A and 2B), the output gear being unitary with the internal output gear, at least one part (preferably one of the ends) of the flexible or deformable rack being affixed directly to the side of the sectional door, the door preferably also being effectively "counter weighted" by either a counterweight of a known kind or a torsional support as shown which preferably attaches to the bottom section of the door in a known way;

Figure 7 is a close up of the engagement of the output gear of or driven by a gear assembly in accordance with the present invention meshing in the flexible rack;

Figure 8 is a similar view to that of Figure 2B but showing the deformable rack within its channel which runs preferably adjacent the channel in which the wheels, rollers or the like of the preferred sectional door also runs; and

Figure 9 shows the form(s) of a preferred flexible rack of the present invention and in such a way as to demonstrate how it may be made by progressive moulding steps.

DETAILED DESCRIPTION

The operation of a sectional door capable of being opened and closed by driving a deformable rack is disclosed in greater detail in our New Zealand patent application being filed simultaneously herewith, the full content of which is here included by way of reference.

The present invention relates to the gearing assembly as well as the related methods and use and includes combinations thereof in respect of door and/or other structures as described and indeed any use thereof for winching or any other such purpose.

The present invention recognises a self braking affect which occurs in the arrangement as depicted when the arrangement as shown in Figures 1 - 3 includes the arrangement as shown in Figure 5 where, for example, the number of teeth respectively on the input and output internal gears is 36 and 37 respectively and the pitch circle diameters are identical. With such an arrangement there is no significant mechanical advantage of one planetary set engagement with its internal gear over the other like engagement thus meaning that input into the system from the output end has great
difficulty because of the 37 or 36 to 1 reduction, in rotating the electric motor input shaft, yet the converse is quite different.

In the preferred form of the present invention there is provided a housing-like structure 1 which includes an internal gear 2 (which is the input gear). As shown in Figure 5 rotatable relative to the preferably fixed internal gear 2 is the input shaft 3 (preferably of an electric motor but of any appropriate input means including a hand cranked input). Splined, keyed or otherwise affixed to that input shaft 3 is a mount, spider or housing 4 which defines a plurality of axes 5 which lie on the circle 6 shown in Figure 5. Each of these axes 5 is defined preferably by axles common for both the planetary gears 7 of the input side and the planetary gears 8 of the output side.

The output side planetary gears 8 mesh with an internal gear 9 which preferably is formed in a member or structure that preferably includes (as part of the output means) a gear 10.

In the preferred form of the present invention the relationship between the pitch circle diameter A' of the input internal gear 2 and the pitch circle diameter B' of the output internal gear 9 is such that they are identical as shown in Figure 5. Preferably the sets of planetary gears 7 and 8 (preferably of identical form) rotate on a common set of axles within the same mount or on the same mount 4. Therefore the pitch circle diameters C' and D' are identical notwithstanding the disparity of (preferably one) teeth between the 36 and 37 teeth of the internal gears 2 and 9 respectively.

With the output internal gear being that with one additional tooth the reduction through the gearbox is of 36 to 1.

With the identical pitch circle diameters A' and B' there is no net mechanical advantage of one planetary system over the other (for example under the loading of a sheet of a yacht or a cable or rope, for example, on a winch, or, for example, the weight of the door on the flexible rack hereinafter described) there is little likelihood of the rotation of the shaft 3 or its equivalent.

The arrangement as depicted in Figure 4 is somewhat different and whilst still confined, by way of example, to an input side internal gear of 36 teeth and an output side internal gear of 37 teeth there is a disparity in the pitch circle diameters. By way of example the pitch circle diameter A could be for example 50.80mm while the pitch circle diameter B could be 52.20mm. In such an arrangement preferably the pitch circle diameters C and D are respectively 16.23mm and 17.63mm in order to provide some semblance of self braking. The self braking however, notwithstanding the disparate tooth numbers on pitch circles A and B (preferably a disparity of one), is not as good as where the pitch circle diameters are identical (eg. as in the case of Figure 5).
Still other variants still within the scope of the present invention are envisaged where there can be adjustments made to cater for differences in pitch circle diameter.

The preferred form of the present invention however has a direct input shaft without an sun gear and simply drives a plurality of spaced planetary axle members which on the input side have idle gears driven by the fixed "input" side internal gear so that the thus driven idle input gears directly drive the planetary gears of the output side thereby imparting a rotational drive (and a drive of significantly increased torque) onto the internal gear of the output side.

Preferably the arrangement as shown irrespective of the number of planetary gear sets (which are preferably identical on both the input and output sides) is such that as shown in Figure 5 the planetary gear pairs 7A and 8A can be moulded with the teeth in phase. Because of the disparity of one between the input and output internal gears preferably however there is a corresponding out of phase relationship between 7B and 8B and between 7C and 8C.

In a preferred form of the present invention a sectional door as might be used for a garage is tracked upwardly and over the top of a door portal, the sections 11 of the door being supported by rollers at each edge. These rollers 12 are preferably guided within a channel 13 which preferably forms part of a structure 14. Structure 14, (best seen by reference to Figure 8, not only defines the channel 13 but also another channel 15 (preferably at least in part constricted at its opening - such a constriction not being shown in Figure 8) which receives there within a flexible or deformable rack 16 preferably to be driven by the output gear 10 of the gear assembly previously described.

Preferably the flexible rack is a member having teeth 17 (see Figure 9) incrementally moulded thereon singly or preferably in groups (preferably simultaneously as a core or other framing member is preferably configured to ensure a good grip of the moulded elements thereon). Preferably the flexible rack is provided with teeth 17 on at least that side to be driven as shown in Figure 7 preferably on a convex curve side of the exposed part of the flexible rack.

Preferably the rack is formed on high tensile strip steel 18 having periodic ridges, kinks or the like 19 (dimples and/or possible even perforations may suffice) onto which the moulded components are formed.

While shown in Figure 9 there are teeth structures on both sides, this is not a necessity. Indeed it is not a necessity also for any such teeth on both sides or any other structure on the non-driven side of the rack to be coincident with projections on the driven side. It is desirable however to maximise flexibility by maintaining a thinness of section through the moulded part of the composite rack between the teeth-like structures.
As shown an upstand or key form 20 formed by the same moulding operation that forms the teeth to the right as shown in Figure 9 can be used in a subsequent presentation within the mould means to key or index upstand 20 internally of a tooth of the next mould sequence.

Preferably the kinks or ridges 19 are indexed to be within the mass of the teeth 17.

A person skilled in the art will appreciate how in a situation as depicted in relation to (by way of example) a garage door, it is possible with a single visit, for a door portal to be prepared and a gear assembly in accordance with the present invention mounted at one side of the door structure in a position capable immediately of being powered to drive the door upwardly and downwardly as required whilst leaving space for the lining of the garage. Hitherto door openers and the like have subsequently been positioned so as to require lining prior to door opener fitment.

It is possible with an arrangement as shown for a drive on one side to be sufficient to operate a door successfully. Such success is better guaranteed where skewing of the door is prevented by appropriate counterweighting on both sides and identical guiding within tracks on each side.

Preferably there is fixing of the flexible rack at one point only of the door. With a sectional door because of the variations in length of the door (as it concertinas slightly during its opening) it is not appropriate to fix the flexible rack at each end. It is better to attach at one point only (preferably the lower end although in other forms the upper end will suffice).

Any form of mechanical connection of the door to the flexible rack is sufficient since the rack is capable of operating in both compression and in tension since it is confined guidably within its channel and is preferably structurally strong enough to cope with loadings.

A motorised door operator with an output shaft preferably directly drives or is part of said input means.

A more complete description of such usage is hereby here incorporated by reference to our NZ Patent Specification No. 299721 (equivalent to PCT/NZ97/...........)

Preferably within the gear assembly dissimilar plastics materials are used for the gearing components so as to minimise wear and noise. Preferably suitable plastics include acetal plastics and/or nylon as the disparate plastic types.

A person skilled in the art will appreciate how the present invention provides an alternative to existing gear assemblies and indeed also provides an alternative to the driving systems available for, for example, garage doors or, for example, winches.
CLAIMS:

1. A gear assembly comprising or having
   input means providing or to provide, or through which can be provided, a
   rotational input;
   means providing a first plurality of planetary axes about and parallel to the
   rotational axis of said input means, said planetary axes to rotate as a group about said
   rotational axis of said input means as and when said input means rotates,
   means providing a second plurality of planetary axes about and parallel to the
   rotational axis of said input means,
   a first set of gears, one mounted on each planetary axis of said first plurality of
   planetary axes,
   a second set of gears, one mounted on each planetary axis of said second plurality
   of planetary axes,
   a first internal gear with which said first set of gears mesh, and
   output means rotatable about an axis at least parallel to the rotational axis of said
   input means, said output means having directly or indirectly a second internal gear with
   which said second set of gears mesh,
   wherein said first plurality of planetary axes are in a fixed relationship with said
   second plurality of planetary axes,
   and wherein the pitch circle of said first and second internal gears is at least
   substantially the same.

2. A gear assembly of Claim 1 wherein said pitch circles are the same.

3. A gear assembly of Claim 1 or 2 wherein there is a disparity in teeth or the
   equivalent meshing elements numbers between said first and second internal gears.

4. A gear assembly as claimed in any one of the preceding claims wherein said input
   means provides without a sun gear for the rotation of said first set of planetary axes.

5. A gear assembly as claimed in any one of the preceding claims wherein said input
   means is a shaft.

6. A gear assembly as claimed in any one of the preceding claims wherein there is
   a disparity in teeth between said first and second internal gears and the gear assembly
   is self braking and is a reduction gearing.

7. A gear assembly as claimed in any one of the preceding claims wherein each axis
   of said first set of axes is coincident with an axis of the second set of axes.

8. A gear assembly as claimed in any one of the preceding claims wherein each gear
   of said first set is attached to or integral with a gear of said second set.

9. A gear assembly as claimed in Claim 8 wherein one only of said integral or
   merged first and second gears has an aligned teeth structure to mesh with both said first
and second internal gears, i.e. preferably the gears otherwise (as between the first and second set pairings) are out of phase.

10. A gear assembly as claimed in any one of the preceding claims wherein the gears of each planetary set have the same teeth numbers.

5 11. A gear assembly as claimed in any one of the preceding claims wherein said planetary mounted first and second sets of gears are substantially encased in a cage or housing.

12. A gear assembly as claimed in any one of the preceding claims wherein the means providing said first and second sets of planetary axes are in the form of a spider or spiders or the equivalent fixed to said input means (e.g. not necessarily a cage or housing).

13. A gear assembly as claimed in any one of the preceding claims wherein said first internal gear forms part of a fitting to an electric motor of which the shaft is said input means.

15 14. A gear assembly of Claim 13 wherein said first or second internal gear is adapted to be disengaged from said input or output means to the extent that when desired it can idle relative thereto.

15. A gear assembly as claimed in any one of the preceding claims wherein said output means is a wheel, roller, capstan, pulley, winch drum, sprocket or an external or other form of gear (i.e.; worm, spur, or other).

16. A gear assembly as claimed in Claim 3 and any claim dependent thereon wherein said disparity in teeth is by an integer of from 1 to 5.

17. A gear assembly of Claim 16 wherein said disparity is from 1 to 4.

18. A gear assembly of Claim 16 or 17 wherein said disparity is 1.

25 19. A gear assembly as claimed in Claim 16, 17 or 18 wherein that internal gear having the fewer teeth is said first or input internal gear.

20. A self braking reduction gear assembly, the assembly having input rotational means and output rotation means,

    wherein the input means through a plurality of planetary gears (planetary of the rotational axis of the input means only, each running on the same internal gear of pitch circle diameter "A" and of teeth number "X", rotates a plurality of planetary gears (also planetary of the rotational axis of said input means) which in turn rotate an output internal gear of pitch circle of diameter "A" (or near "A") and of teeth numbers "X" ± "α", where α is a small integer or zero of the output means,

    and wherein input via the output means does not correspondingly provide any output via the input means.
21. An assembly of Claim 20 wherein said input means includes no sun gear to its planetary gears.

22. An assembly of Claim 20 or 21 wherein \( \alpha \) is at least 1.

23. A gear assembly as claimed in Claim 20, 21 or 22 wherein the internal gear of the output means is of teeth number "X"-"\( \alpha \)".

24. A method of transferring a rotational input at input means at increased torque to output means, said method comprising rotating planetary idling gears by meshing each with an internal gear as the axis of each idling gear rotates planet-like about a rotational input axis defined by means which causes the planetary movement of the idling gear axes, and using each idling gear to drive directly or indirectly a planetary gear of a second set of planetary gears (that are planetary with respect to the input axis) such that the second set of planetary gears mesh engage with and drive the rotation of an internal gear (directly or indirectly) of output means.

25. A method of Claim 24 wherein the first mentioned set of planetary idling gears includes no sun gear.

26. A method as claimed in Claim 24 or 25 wherein the mechanism is self braking.

27. A method as claimed in Claim 26 wherein each internal gear is of substantially the same pitch circle and the teeth numbers on each internal gear differs.

28. A method as claimed in Claim 24 or 25 wherein each planetary gear (set to set) is of the same pitch diameter.

29. A method as claimed in any one of claims 24 to 28 wherein some at least of the second set of planetary gears have teeth offset from those of the first set to accommodate a teeth number difference in said two internal gears.

30. A method as claimed in Claim 24 or 25 wherein the pitch circles of the internal gears are almost the same and the planetary gears provide at least "near" self braking.

31. A gear assembly substantially as hereinbefore described with reference to any one or more of the accompanying drawings.
A. **CLASSIFICATION OF SUBJECT MATTER**

Int Cl: F16H 1/36, 1/28

According to International Patent Classification (IPC) or to both national classification and IPC

B. **FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC: F16H 1/36, 1/28, 1/46

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

AU: IPC as above

Electronic database consulted during the international search (name of database and, where practicable, search terms used)

DERWENT

USPO

C. **DOCUMENTS CONSIDERED TO BE RELEVANT**

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<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<td>X</td>
<td>US 5435794A (MORI et al) 25 July 1995 Whole document, Figs 1-6</td>
<td>1,3-8,10-13,15-17, 19-28,30</td>
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<td>X</td>
<td>US 3705522 A (OGAWA) 12 December 1972 Whole document</td>
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<td>X</td>
<td>US 4043216 A (STEER) 23 August 1977 Whole document</td>
<td>1-2,4,5,7-8,10-12, 15,20-21,24-26,28</td>
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☐ Further documents are listed in the continuation of Box C  

☐ See patent family annex

**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 doubts 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 when the document is taken alone
- **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 document member of the same patent family

Date of the actual completion of the international search  5 January 1998

Date of mailing of the international search report  **16 JAN 1998**

Name and mailing address of the ISA/AU

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Authorized officer

KURT TOBLER

Telephone No.: (02) 6283 2469
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<td>This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:</td>
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<tr>
<td>1.</td>
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<td>because they relate to subject matter not required to be searched by this Authority, namely:</td>
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<td>2.</td>
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<td>because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:</td>
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<td>3.</td>
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<td>because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)</td>
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<td>1.</td>
<td>As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims</td>
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<td>3.</td>
<td>As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:</td>
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<td>4.</td>
<td>No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:</td>
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| Remark on Protest | The additional search fees were accompanied by the applicant's protest. |
| | No protest accompanied the payment of additional search fees. |
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.

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END OF ANNEX