

TRANSMISSIONS INCORPORATING EDDY CURRENT BRAKING**TECHNICAL FIELD**

Described herein is a transmission mechanism and method of use incorporating eddy current drag
5 elements and in doing so controlling or tailoring movement between members.

BACKGROUND ART

The applicant's co-pending and granted patents in the field of eddy current related devices include US
8,851,235, US 8,490,751, NZ619034, NZ627617, NZ627619, NZ627633, NZ627630 and other equivalents
10 all incorporated herein by reference. The devices described in these patents/applications may be useful,
for example due to their providing frictionless methods of controlling movement. However, other
methods of altering eddy current interactions and transmitting eddy current interactions may also be
achieved or at least provide the public with a choice.

Further aspects and advantages of the transmission mechanisms and methods of use should become
15 apparent from the ensuing description that is given by way of example only.

SUMMARY

Described herein is a transmission mechanism and method of use for braking relative movement
between members, movement and braking of the members being directed through one or more
20 transmission elements. The transmission mechanism and method of use allows for enhanced
braking/retarding performance thereby providing a greater performance to that observed where the
eddy current elements are directly coupled to an external motive source.

In a first aspect, there is provided a transmission mechanism comprising:

- at least one driving member (motive source); and
- 25 at least one driven member, movement of the at least one driven member urged via
transmission of movement from the at least one driving member;
- drag force inducing elements that move at different relative rates comprising at least one
electrical conductor and at least one magnet, each element coupled with the transmission mechanism in
a manner that allows the elements to interact on movement and generate eddy current drag forces, the
30 elements thereby acting to govern the rate of movement between the driving and driven members.

In a second aspect, there is provided a method of transferring an eddy current drag force between
members by the step of:

- (a) selecting a transmission mechanism substantially as described herein;
- (b) applying a motive force on the at least one driving member that in turn applies a motive force on the at least one driven member;
- (c) by causing motion of the at least one driven member, inducing an eddy current drag force on either the at least one driving member or at least one driven member thereby retarding movement of the member or members directly or indirectly via the transmission.

Advantages of the above described transmission mechanism and method of use includes the ability to direct and transfer an eddy current drag force directly or indirectly. Transmission of the eddy current induced force also allows the ability to multiply the brake effects thereby increasing the efficiency of the mechanism compared to a directly coupled eddy current brake mechanism.

BRIEF DESCRIPTION OF THE DRAWINGS

Further aspects of the transmission mechanisms and methods of use will become apparent from the following description that is given by way of example only and with reference to the accompanying drawings in which:

Figure 1 illustrates an example of a bevel gear transmission;

Figure 2 illustrates an example of a bevel gear transmission mechanism incorporating an eddy current drag element;

Figure 3 illustrates images of a spool and gear transmission embodiment;

Figure 4a illustrates perspective and elevation views of a worm drive and spool embodiment;

Figure 4b illustrates an elevation view of an image of a plunger arrangement also using a worm drive with the plunger elements engaged; and

Figure 4c illustrates an elevation view of an image of a plunger arrangement also using a worm drive with the plunger elements dis-engaged.

DETAILED DESCRIPTION

As noted above, described herein are transmission mechanisms and methods of use for braking relative movement between members, movement and braking of the members being directed through one or more transmission elements. The transmission mechanism and method of use allows for enhanced braking/retarding performance thereby providing a greater performance to that observed where the eddy current elements are directly coupled to an external motive source.

For the purposes of this specification, the term 'about' or 'approximately' and grammatical variations thereof mean a quantity, level, degree, value, number, frequency, percentage, dimension, size, amount,

weight or length that varies by as much as 30, 25, 20, 15, 10, 9, 8, 7, 6, 5, 4, 3, 2, or 1% to a reference quantity, level, degree, value, number, frequency, percentage, dimension, size, amount, weight or length.

5 The term 'substantially' or grammatical variations thereof refers to at least about 50%, for example 75%, 85%, 95% or 98%.

The term 'comprise' and grammatical variations thereof shall have an inclusive meaning - i.e. that it will be taken to mean an inclusion of not only the listed components it directly references, but also other non-specified components or elements.

In a first aspect, there is provided a transmission mechanism comprising:

10 at least one driving member (motive source); and

at least one driven member, movement of the at least one driven member urged via transmission of movement from the at least one driving member;

eddy current drag force inducing elements that move at different relative rates comprising at least one electrical conductor and at least one magnet, each element coupled with the transmission mechanism in a manner that allows the elements to interact on movement and generate eddy current drag forces, the elements thereby acting to govern the rate of movement between the driving and driven members.

20 The transmission may translate movement of the driving member to movement of the at least one second driven member. For example, transmitting rotation of the driving member shaft to rotation of the driven member shaft. Transmission may be via a gear box coupling, , a cog or cogs. Transmission may be via a coupling that does not utilise fasteners so that the driving and/or driven member(s) may be releasably linked together.

25 As noted above, eddy current drag force inducing elements may be incorporated into the mechanism. Eddy current drag is induced when an electrically conductive element moves in a magnetic field (or vice versa), the eddy current drag forces induced then slow relative movement between the conductive element and the magnetic field.

The at least one conductor may be directly coupled to the at least one driving member (motive source) and the at least one magnet is indirectly coupled to the at least one driving member (motive source) via the transmission mechanism, and wherein:

- 30 (a) the transmission mechanism moves both elements rotationally;
- (b) the reaction torque (eddy current drag force effects) induced by the elements is transferred into the driving member of the transmission mechanism.

Alternatively, the at least one magnet may be directly coupled to the at least one driving member (motive source) and the at least one conductor is indirectly coupled to the at least one driving member

(motive source) via the transmission mechanism, and wherein:

- (a) the transmission mechanism moves both elements rotationally;
- (b) the reaction torque (eddy current drag force effects) induced by the elements is transferred into the driving member of the transmission mechanism.

5 The at least one electrical conductor and the at least one magnet may be independent to each other and indirectly coupled to the at least one driving member by the transmission mechanism. One type of transmission mechanism employing this arrangement may be a bevel drive. As may also be appreciated, this arrangement also allows the possibility of having varying transmission ratios for both the at least one conductor and at least one magnet.

10 The at least one driving member may be a shaft or coupling that rotates. A rotational driving torque may be imposed by a force. For example, the force may be generated by an object linked to the driving member, non-limiting examples including a wheel or an object linked to a spool via a line, the spool rotating when the object causes the line to pay out from the spool as may be the case for autobelay or fall safety apparatus. These devices are described in more detail below.

15 The at least one second driven member may be a shaft or coupling that also rotates.

In the above embodiment, rotational movement of the at least one driving member urges at least two driven members to rotate in opposite directions.. In one embodiment, the driving member and at least one driven member in a rotational embodiment may be angled relative to each other, movement being transmitted via the transmission in a different (opposite) direction. The angle of translation may range
 20 from at least 1, or 5, or 10, or 15, or 20, or 25, or 30, or 35, or 40, or 45, or 50, or 55, or 60, or 65, or 70, or 75, or 80, or 85, or 90 degrees. In such embodiments, a bevel gearbox may be used to drive the change in angle. Whilst not essential, this arrangement of the driven members working together via an eddy current interaction may provide a particularly strong brake action in the embodiment described above – counter rotation occurs between the driven members effectively amplifying (inducing double)
 25 the eddy current drag force owing to the opposing relative movement between the magnetic field and conductor.

Rotational movement alone as noted above should not be seen as limiting as, for example, the driven member or members may instead undergo a linear and/or axial translation as well, an example of which is described further below.

30 The transmission mechanism may move both members rotationally about a fixed axis. In one embodiment, the fixed axis may be a common axis between the elements although offset axes may also be used.

The ratio of movement between the driving and driven members may be pre-determined or pre-set. This may be achieved for example via a tooth and cog gear arrangement. In one embodiment, the ratio
 35 of movement between the driving and driven members may range from approximately 1:0.001 to

1:1000. The ratio of driving and driven members may be approximately 1:0.001, or 1:0.005, or 1:0.01, or 1:0.05, or 1:0.1, or 1:0.5, or 1:1 or 1:5, or 1:10, or 1:50 or 1:100, or 1:500, or 1:1000 although other ratios may be useful depending on the end application for the mechanism. In one embodiment, the ratio of movement between the driving and driven members may be approximately 1:1 although other ratios may be useful depending on the end application for the mechanism.

In one example, the transmission mechanism may be arranged so that:

- (a) the at least one conductor rotates at a rotational velocity governed by the transmission ratio and the driving member (motive source) velocity; and
- (b) the at least one magnet rotates at a rotational velocity governed by the transmission ratio and the driving member velocity in a rotational direction opposite the direction of rotation of the conductor.

The rate of movement of the driving and driven members may vary once eddy current drag forces are induced and continue to vary until a critical velocity is reached, the critical velocity being where the eddy current drag force does not increase with increased rotational velocity acting on the at least one driving member.

On initiation of eddy current drag force generation, up to a critical velocity applied to the at least one driving member, the braking torque between the eddy current elements increases by twice the transmission ratio.

On initiation of eddy current drag force generation, up to a critical velocity applied to the at least one driving member, the braking torque between the eddy current elements may act on both the at least one driven and at least one driving members via the transmission.

Alternatively, on initiation of eddy current drag force generation, up to a critical velocity applied to the at least one driving member, the braking torque between the eddy current elements may act on the at least one driving member via the transmission and at least one driven member. In this embodiment, the eddy current elements may not be directly coupled to the at least one driving member. This embodiment may be used where further multiplication in torque achieved over an eddy current brake effect may be desired with the at least one driving member coupled to only one eddy current element (at least one conductor or at least one magnet).

Above the critical velocity, the reaction torque may remain multiplied relative to a directly coupled system and the reaction torque remains approximately constant with variation in speed above the critical velocity.

As may be appreciated from the above, the mechanism described allows considerably increased drag force effects than a directly coupled eddy current drag mechanism. In other words, up to the critical velocity and torque of the eddy current drag force effects, the mechanism described herein may:

- Approximately double the braking torque in rotational speeds up to the critical velocity of the

eddy current drag force action on the on the transmission members;

- Causes the approximately doubled torque on the eddy current elements to act on the driving member (motive source) in two locations, thereby doubling the torque further;
- It can be seen that this provides approximately four times the reaction torque to the motive force over that of the same eddy current elements directly coupled to the driving member (motive force). Further, the critical velocity apparent at the motive input is half of that of a directly coupled system.

As noted above, the critical velocity is a point where the eddy current drag force does not increase with increased rotational velocity and the reaction torque remains multiplied over a directly coupled system and approximately constant and/or controlled. That is, above the critical velocity, an extra force input into the driving member leads to the same eddy current drag force output.

The transmission mechanism may be a worm drive. The term 'worm drive' refers to a gear arrangement where a worm (gear in the form of a screw) meshes with a mating gear. Other types of drive with a similar mechanism are also encompassed with this term including helical gears with angularly offset axes and/or helical spur gears with axes of rotation angularly rotated to each other. In this embodiment, the transmission may operate in the mode of providing a step up in velocity from the rotational velocity of the driving member to the rotational velocity of the eddy current inducing element or elements thereby providing a resisting force to the rotational velocity of the driving member.

The transmission ratio and/or coefficient of friction at the gear interface may be selected such that the transmission operates with a prescribed level of mechanical efficiency. The prescribed level of mechanical efficiency may be sufficiently low to provide a supplementary retarding torque over that provided by the induced eddy current drag force and the numerical gear ratio alone. In practice it is envisaged that the mechanism may have a low mechanical efficiency – that is, there would be significant mechanical losses in the transmission. The prescribed level of mechanical efficiency (if low) results in an increase on the reaction torque on the motive force in excess of that conferred by the eddy current drag force and the numerical gear ratio alone. A benefit of this is that the mechanical losses in the worm system can be used as a supplementary retarding torque, proportional to the eddy current drag force, as governed by the laws of friction, thereby decreasing the torque demand required of the eddy current drag force over an eddy current brake system coupled with a very high efficiency transmission system.

In the above worm drive embodiment, a friction torque may be held approximately in proportion to the eddy current element induced braking torque. As may be appreciated, this arrangement may act to amplify the eddy current induced braking torque.

The transmission mechanism may be configured to comprise a worm drive using an axially fixed eddy current element retaining worm. As may be appreciated this is a very simple arrangement yet this achieves the desired objective of transmitted driving and driven elements with eddy current induced braking effects on movement.

The transmission mechanism may be configured to comprise:

a tube including a wall and void defined therein;

a cylinder that fits into the tube void, the cylinder being a driven member linked to a driving member providing an input torque, the cylinder moving in response to an input torque on the driving member relative to the tube via axial translation of the cylinder relative to the tube so that the cylinder can pass at least partially into or out of the tube void; and rotation of the cylinder relative to the tube about a longitudinal axis, the axis passing through the tube void;

wherein, coupled to the tube and cylinder are one or more eddy current inducing elements and, in use, the cylinder and tube have different relative speeds of rotation to each other such that, when the tube and/or cylinder is or are moved via axial translation caused by the driven member so that the cylinder at least partially enters the tube void, a braking reaction force on rotation of the driven member occurs due to induced eddy current drag force generation thereby slowing the velocity of rotation of the driving member.

In the above configuration, the degree of overlap between the tube and cylinder may determine the degree of eddy current induced drag force.

The axial force applied to the cylinder may be imposed by the driven member, the degree of axial force applied being proportional to the torque acting on the driving member. Imposing may be via a reaction force acting on the driven member causing driven member movement e.g. extension of the worm along the line of a shaft that is the driven member causing driven member rotation. This example should not be seen as limiting as it should be appreciated that the imposed axial force may be applied in many different ways to suit the end application.

The transmission used in the above tube and cylinder embodiment may be a worm drive, the term 'worm drive' defined in a similar manner to that noted above except in this case the worm drive is incorporated into the tube and cylinder arrangement.

The eddy current elements may be selectively coupled to the driven member (or worm element if used), whereby the axial force applied to the driven member may be used to engage and disengage a coupling connecting the driven member to the eddy current elements. Engagement occurs in response to a force threshold having been achieved. Disengagement occurs in response to a force threshold having been achieved. An engaging effect may be useful to allow movement under a range of 'normal' scenarios for a device in which the mechanism is used, but, on application of a predetermined force, engagement and braking then occurs (and disengagement as well once the predetermined force is reached post engagement). Movement of the eddy current elements (magnets and conductor(s)) together or apart to engage or disengage may be urged via a mechanism such as a bias mechanism.

In a second aspect, there is provided a method of transferring an eddy current drag force between members by the step of:

- (a) selecting a transmission mechanism substantially as described herein;
- (b) applying a motive force on the at least one driving member that in turn applies a motive force on the at least one driven member;
- (c) by causing motion of the at least one driven member, inducing an eddy current drag force on either the at least one driving member or at least one driven member thereby retarding movement of the member or members directly or indirectly via the transmission.

Final embodiments for the transmission mechanism described herein may be varied. For example, an autobelay or self retracting lifeline (SRL) embodiment may use the transmission mechanism and method of use described. In an SRL embodiment, a line may extend and retract from the SRL device and when the line extends from the SRL device at a rate beyond a predefined threshold, the transmission mechanism engages and applies a retarding force on the rate of line extension. SRL and autobelay applications should not be seen as limiting since the transmission mechanisms described may be used for a wide variety of other applications, non-limiting examples including speed control or load control of:

- A rotor in a rotary turbine;
- Exercise equipment e.g. rowing machines, epicyclic trainers, weight training equipment;
- Roller-coasters and other amusement rides;
- Elevator and escalator systems;
- Evacuation descenders and fire escape devices;
- Conveyer systems:
- Rotary drives in factory production facilities;
- Materials handling devices such as conveyer belts or a braking device in a chute;
- Roadside safety systems e.g. the energy absorber may be connected in a system to provide crash attenuation through the dissipation of energy via the energy absorber;
- Seat belts in vehicles;
- Zip lines;
- Braking mechanisms for trolleys and carriages;
- Bumpstops in transport applications;
- Bumpstops in crane applications;
- Torque or force limiting devices in mechanical drive train;
- Structural overload protection in wind turbines;
- Load limiting and energy dissipation in structures, buildings and bridges.

Advantages of the above described transmission mechanism and method of use includes the ability to direct and transfer an eddy current drag force directly or indirectly. Transmission of the eddy current induced force also allows the ability to multiply the brake effects thereby increasing the efficiency of the mechanism compared to a directly coupled eddy current brake mechanism.

The embodiments described above may also be said broadly to consist in the parts, elements and

features referred to or indicated in the specification of the application, individually or collectively, and any or all combinations of any two or more said parts, elements or features.

Further, where specific integers are mentioned herein which have known equivalents in the art to which the embodiments relate, such known equivalents are deemed to be incorporated herein as of

5 individually set forth.

WORKING EXAMPLES

The above described transmission mechanism and method of use is now described by reference to specific examples.

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EXAMPLE 1

Figure 1 illustrates a bevel gear transmission 1. The driving member 2 drives movement of the driven members 3,4 via a cog arrangement 5. Rotation movement of the driving member 2 drives counter rotating movement shown by the arrows A and B of the driven members 3,4. Gearing may be used on the cogs to increase or decrease relative counter rotation of the driven members.

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Figure 2 illustrates how an eddy current drag inducing element may be integrated into the bevel gear transmission 1 shown in Figure 1. Figure 2 shows a driving member 2 that rotates to impart rotation movement on the driven members 3,4. Movement is transmitted via the transmission about a 90 degree bend 5. By virtue of this force transmission the driven members 3,4 oppose each other and they counter rotate relative to each other. An eddy current drag element may be integrated into the transmission mechanism by use of magnets 6 located about the axis of a first driven member 3 and a shaft 7 extending from the axis of the second driven member 4 that acts as a conductor 7 which interacts with the magnetic field created by the magnets 6 on the first driven member 3. Since the driven members 3,4 are positioned opposite each other a common axis of rotation can integrate the eddy current drag element. As noted above, the bevel gear transmission 5 imparts counter rotational movement of the driven members 3,4. This has the advantage of effectively doubling the eddy current induced forces since the relative motion between the driven members 3,4 is potentially equal and opposite rotation. It should be appreciated that the magnets 6 and conductor 7 may be reversed with the magnets 6 being located on the second driven member shaft 4 and the conductor 7 being located about the first driven member 3.

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EXAMPLE 2

Figure 3 illustrates a potential product embodiment where the driving member is coupled to a spool 10 of line 11, the line 11 attached to an object such as a person (not shown). In the event of line 11 being

drawn from the spool 10, spool 10 rotation occurs that in turn causes rotation of the driven members 12,13. The driven members 12,13 incorporate an eddy current drag element 14 and when rotation occurs, a drag force is imparted on the spool 10 via the transmission mechanism 15. In Figure 3, the eddy current drag element comprises an axial shaft 16 extending from the first driven member 12 and a
5 conductive member 17 on the shaft 16 that may move rotationally with the shaft 16 and axially based on an urging force (not shown). The second driven member 13 includes a hollow cylindrical extension 18 located with a common axis of rotation X with the second driven member 13 (and first driven member 12). The inside of the hollow cylinder 18 may be lined with magnets 19 to create a magnetic field inside the hollow cylinder 18. Driving member 10 movement causes counter rotational driven members 12,13
10 movement via the transmission 15. Axial movement of the conductive member 17 on the first driven member 12 may occur moving the conductive member 17 into the hollow cylinder 18 thereby inducing eddy current drag interactions. This in turn brakes relative movement between the driven members 12,13 which, via the transmission 15, brakes movement of the driving member 10.

15 EXAMPLE 3

Figure 4a illustrates an alternative embodiment using a worm drive 30 as a driven member and a spool 31 with line 32 acting as the driving member. The worm drive 30 acts as a transmission mechanism transmitting rotational movement of the spool 31 into rotational and axial movement of the worm drive 30. The worm drive 30 may include an eddy current drag element 35.

20 In Figure 4b, the eddy current drag element comprises a hollow cylinder 33 with a magnetic field generated by magnets 33A and a conductive member (a plunger) 34 that moves rotationally and, optionally axially, into and out of the magnetic field. When the plunger 34 is in the magnetic field, eddy current drag forces are induced thereby slowing rotation and/or axial translation of the worm drive 30. This in turn slows movement of the spool 31 or driving member. The plunger 34 may move axially in
25 response to the axial thrust provided by the worm drive 30. Figure 4c illustrates how the plunger 34 and cylinder 33 may separate via axial translation along a common axis of rotation. Once separated, the parts may not incur and eddy current braking effects but can engage once a predetermined force threshold is reached

Aspects of the transmission mechanism and method of use have been described by way of example only
30 and it should be appreciated that modifications and additions may be made thereto without departing from the scope of the claims herein.

WHAT IS CLAIMED IS:

1. A transmission mechanism comprising:

at least one driving member ; and

at least one driven member, movement of the at least one driven member urged via transmission of movement from the at least one driving member;

drag force inducing elements that move at different relative rates comprising at least one electrical conductor and at least one magnet, each element coupled with the transmission mechanism in a manner that allows the elements to interact on movement and generate eddy current drag forces, the elements thereby acting to govern the rate of movement between the driving and driven members.

2. The transmission mechanism as claimed in claim 1 wherein the at least one conductor is directly coupled to the at least one driving member (motive source) and the at least one magnet is indirectly coupled to the at least one driving member (motive source) via the transmission mechanism, and wherein:

- (a) the transmission mechanism moves both elements rotationally;
- (b) the reaction torque (eddy current drag force effects) induced by the elements is transferred into the driving member of the transmission mechanism.

3. The transmission mechanism as claimed in claim 1 wherein the at least one magnet is directly coupled to the at least one driving member (motive source) and the at least one conductor is indirectly coupled to the at least one driving member (motive source) via the transmission mechanism, and wherein:

- (a) the transmission mechanism moves both elements rotationally;
- (b) the reaction torque (eddy current drag force effects) induced by the elements is transferred into the driving member of the transmission mechanism.

4. The transmission mechanism as claimed in any one of the above claims wherein the at least one electrical conductor and the at least one magnet may be independent to each other and indirectly coupled to the at least one driving member by the transmission mechanism.

5. The transmission mechanism as claimed in any one of claims 2 to 4 wherein rotational movement of the at least one driving member urges at least two driven members to rotate in opposite directions.

6. The transmission mechanism as claimed in any one of claims 2 to 5 wherein the transmission mechanism moves both members rotationally about a fixed axis.
7. The transmission mechanism as claimed in claim 6 wherein the fixed axis is a common axis between the elements.
8. The transmission mechanism as claimed in any one of the above claims wherein the ratio of movement between driving and driven members is pre-determined.
9. The transmission mechanism as claimed in claim 7 wherein the ratio of movement between driving and driven members ranges from approximately 1:0.001 to 1:1000.
10. The transmission mechanism as claimed in claim 9 wherein:
- (a) the at least one conductor rotates at a rotational velocity governed by the transmission ratio and the driving member (motive source) velocity; and
 - (b) the at least one magnet rotates at a rotational velocity governed by the transmission ratio and the driving member velocity in a rotational direction opposite the direction of rotation of the conductor.
11. The transmission mechanism as claimed in any one of the above claims wherein the rate of movement of the driving and driven members vary once eddy current drag forces are induced and continue to vary until a critical velocity is reached, the critical velocity being where the eddy current drag force does not increase with increased rotational velocity acting on the at least one driving member.
12. The transmission mechanism as claimed in any one of claims 1 to 10 wherein, on initiation of eddy current drag force generation, up to a critical velocity applied to the driving member, the braking torque between the eddy current elements increases by approximately twice the transmission ratio.
13. The transmission mechanism as claimed in any one of the above claims wherein, on initiation of eddy current drag force generation, up to a critical velocity applied to the at least one driving member, the braking torque between the eddy current elements acts on both the at least one driven and at least one driving member via the transmission.

14. The transmission mechanism as claimed in any one of claims 1 to 12 wherein, on initiation of eddy current drag force generation, up to a critical velocity applied to the at least one driving member, the braking torque between the eddy current elements acts on the at least one driving member via the transmission and at least one driven member.

15. The transmission mechanism as claimed in any one of claims 11 to 14 wherein above the critical velocity, the reaction torque remains multiplied relative to a directly coupled system and the reaction torque remains approximately constant with variation in speed above the critical velocity.

16. The transmission mechanism as claimed in claim 1 wherein the transmission mechanism is a worm drive.

17. The transmission mechanism as claimed in claim 16 wherein the transmission operates in the mode of providing a step up in velocity from the rotational velocity of the driving member to the rotational velocity of the eddy current inducing element or elements thereby providing a resisting force to the rotational velocity of the driving member.

18. The transmission mechanism as claimed in claim 16 or claim 17 wherein the transmission ratio and/or coefficient of friction is selected such that the transmission operates with a prescribed level of mechanical efficiency.

19. The transmission mechanism as claimed in claim 18 wherein the prescribed level of mechanical efficiency is sufficiently low to provide a supplementary retarding torque over that provided by the induced eddy current drag force and the numerical gear ratio alone.

20. The transmission mechanism as claimed in any one of claim 16 to 19 wherein a friction torque is held approximately in proportion to the eddy current element induced braking torque.

New Claim – about having the friction torque being in proportion to the ECB braking torque, thereby amplifying the ECB braking torque?

21. The transmission mechanism as claimed in claim 1 wherein the transmission mechanism is configured to comprise:

a tube including a wall and void defined therein;

a cylinder that fits into the tube void, the cylinder being a driven member linked to a driving member providing an input torque, the cylinder moving in response to an input torque on the driving member relative to the tube via axial translation of the cylinder relative to the tube so that the cylinder can pass at least partially into or out of the tube void; and rotation of the cylinder relative to the tube about a longitudinal axis, the axis passing through the tube void;

wherein, coupled to the tube and cylinder are one or more eddy current inducing elements and/or one or more magnetic attraction effects; and,

in use, the cylinder and tube have different relative speeds of rotation to each other such that, when the tube and/or cylinder is or are moved via axial translation caused by the driven member so that the cylinder at least partially enters the tube void, a braking reaction force on rotation of the driven member occurs due to induced eddy current drag force generation thereby slowing the velocity of rotation of the driving member.

22. The transmission mechanism as claimed in claim 21 wherein the degree of overlap between the tube and cylinder determines the degree of eddy current induced drag force and/or magnetic attraction effect.

23. The transmission mechanism as claimed in claim 21 or claim 22 wherein the axial force applied to the cylinder is imposed by the driven member, the degree of axial force applied being proportional to the torque acting on the driving member.

24. The transmission mechanism as claimed in any one of claims 21 to 23 wherein the transmission is a worm drive.

25. The transmission mechanism as claimed in claim 24 wherein the eddy current elements are selectively coupled to the worm element, whereby the axial force applied to the worm gear is used to engage and disengage a coupling connecting the worm drive to the eddy current elements.

26. The transmission mechanism as claimed in claim 25 wherein engagement occurs in response to a force threshold having been achieved.

27. The transmission mechanism as claimed in claim 26 wherein disengagement occurs in response to a force threshold having been achieved.

28. A method of transferring an eddy current drag force between members by the step of:

- (a) selecting a transmission mechanism as claimed in any one of the above claims;
- (b) applying a motive force on the at least one driving member that in turn applies a motive force on the at least one driven member;
- (c) by causing motion of the at least one driven member, inducing an eddy current drag force on either the at least one driving member or at least one driven member thereby retarding movement of the member or members directly or indirectly via the transmission.

29. An autobelay incorporating the transmission mechanism as claimed in any one of claims 1 to 27.

30. A self retracting lifeline (SRL) incorporating the transmission mechanism as claimed in any one of claims 1 to 27.