Abstract: A reference guide or gauge for setting the position of a fifth wheel coupling (15) upon a tractor trailer combination, features an elongate extendible linear bar with one or more juxtaposed elongate marker rules or guides (20), each sub-divided by a series of markings representing indexed relative positions for relative tractor trailer disposition, and related respectively to a distance between trailer (11) front wall and tractor cab (10) rear wall and tractor cab chassis (16) rear end and trailer underside legs (14) or base step wall (17); along with an alignment reference marker (26) for setting in relation to both scales, as an indicator of fifth wheel position to allow operating clearance between tractor (10, 16) and trailer (11). A combination extendible rule is envisaged for both trailer and both factor measurements. Dual considerations of operational clearance to avoid mutual impact or collision and minimizing trailer front wall to tractor cab rear wall clearance for reduced induced, profile or form drag and thus improved fuel economy.
Fifth Wheel Setting Guide
for Tractor- (Articulated) Trailer Combination

This invention relates to so-called 'fifth wheel' articulated tractor-trailer (inter-) coupling through co-operative inter-engagement and interaction between a tractor-mounted turntable or swivel bed and a depending trailer front end swivel pin. The trailer is sometimes referred to as a 'semi-trailer', a towing truck or tractor units as a dolly.

Background

A coupling pin or king pin or nipple on the front of the (semi-) trailer interacts with a horseshoe-shaped coupling within a grease lubricated turntable bearing, rubbing or skid plate, called a fifth wheel, on the rear of the tractor. The turntable is mounted on a transverse pivot with limited tilt range to accommodate relative tractor-trailer vertical pitching movement. Major fifth wheel manufacturers include ...

Jost Automotive, Germany (http://www.jost.co.uk);
George Fisher Automotive, Germany (http://www.vkt.georgfischer.com); and

An articulated or semi-trailer has advantages of flexibility in use, with quick (un)coupling, sequential chained coupling, easier reversing, smaller (than overall trailer length) turning circle, as compared to 'full' trailers. Disadvantages include weight transfer to and sharing with the tractor and a high centre of gravity, reducing stability, loss of traction, with vulnerability to jack-knifing (tractor rearward out swing overtaking a tractor).

Retractable landing gear, typically telescopic struts, with wind in-out rack gear and wheel or skid feet support the front end of the trailer for tractor uncoupling and separation. These same supports represent a collision hazard when reverse manoeuvring a tractor towards a stationary trailer for mutual alignment and coupling. Thus trailer light damage by support leg / strut contact is common.

The pivot pin is typically of standardised (for universality of fit) waisted, relieved shank or stepped profile, giving a capture head or flange and base shoulder upon a swivel stem mounted upon a forged retention plate. A releasable swivel clamp anchor jaw, operable by, say, a manual push-pull handle or swing arm, is typically mounted in the tractor turntable for trailer pin release and capture. Automatic pin-sensing and remote powered locking devices are available.

The fifth wheel turntable is either of fixed disposition, or movably-mounted upon an adjustable slide (such as an indexed 'pin detent and slot' rack, toothed rack and helical pinion, helical screw and traveller worm gear, or linear slide rod and clamp) to allow for and aft re-positioning according to the particular trailer to be hitched up. Such a slide may provide a series of indexed positions, say in circa 50mm steps.

Operational (Tractor - Trailer) Clearance + Fuel Saving

The Applicant perceives that fifth wheel (longitudinal or horizontal) adjustability affords an opportunity not only to obviate tractor - trailer collision risk, but to close down the gap between tractor and trailer to a minimum consistent with mutual of relative clearance. This has been found from operational experience to reduce aerodynamic (form) drag and improve fuel economy (circa 2% saving has been achieved) without resort to elaborate or bespoke constructional measures such as a cap roof aerofoil and/or trailer front and roof curvature. For an inherently high fuel consumption large diesel tractor engine and long trip mileages this represents a significant cost saving.

For a fixed fifth wheel and fixed matched or mutually compatible tractor trailer combination the opportunities for operational savings are constrained - at least beyond an initial set-up (ie of a permanent fifth wheel bed disposition). Rather, the Applicant is concerned with mixed and variable fleet operation.
Problem

Appropriate fifth wheel position setting requires some knowledge of key dimensions and geometry of the tractor-trailer combination. However, two independent spacing factors must be considered and inter-related for a compromise fifth wheel setting, viz:

1. the ‘above’ distance (taken ‘above’ the tractor chassis bed) between the rear of a tractor cab and the front wall of a trailer; along with ...

2. the ‘below’ distance (taken ‘below’ the tractor chassis bed) between the rear of the tractor chassis bed and the trailer legs or stepped underside.

Both ‘above’ and ‘below’ distances vary with tractor and trailer respective model types, so a driver must determine by prior knowledge, visual inspection, judgement, laborious measurement or look-up reference data, an appropriate fifth wheel longitudinal positional setting. None of these is practical and in any event entirely without uncertainty and risk of mis-calculation, mis-setting and consequent damage.

Fifth wheel setting must accommodate maximum trailer swing interference condition (this generally arises with respective tractor and trailer axes at 45 degrees) and preserve operating clearance between trailer and tractor (taking account of both tractor cab end wall and chassis bed end).

The trailer pin is typically of fixed position on a trailer, so the only provision for relative longitudinal adjustment of tractor and trailer is through fifth wheel bed mobility.

Generally, the ‘radius of action’ of a trailer about its pivot pin, that is the (fixed upon build) distance of the pivot pin from the trailer front corner, must be somewhat less than the rearward longitudinal distance of the fifth wheel from the rear of the tractor cab. This is to provide a safe intervening operating clearance. Some cab and trailer bodies feature curved or rounded corner edges to help mutual clearance at the angular extremities of relative articulation.

Another issue arises with vertical positioning of the fifth wheel turntable upon a tractor rear stub chassis, (where such adjustment is provided) and attendant trailer top height, to preserve roadway clearance, such as through tunnels or under bridges.

Extendible pins and fifth wheel beds are known for vertical height adjustment on light commercial (horse trailers) and recreational vehicles RVs) common in the USA, but have not been applied to heavy cargo haulage.

Hitherto, driver-operators have not had an opportunity to practice, let alone been examined or tested, upon ‘working-out’ and making this setting for a diversity of trailers or tractor-trailer combinations. The Applicant foresees, as a long term commercial and technical strategy, promotion of a change in driver training proficiency rules of the driving standards agency and vehicle inspectorate to allow for this, eventually making it compulsory. in turn this would require a reference facility and test rig - both of which the Applicant proposes with the present invention.

Broad competency would require a demonstrated ability to approach and set up a strange tractor and trailer combination without pre-briefing and with complete confidence. A fail-safe cross-check upon fifth wheel turntable position setting (i.e. not merely locking security) before coupling, departure and use might be devised - even with an interlock to inhibit drive away until a check / test pass.

Yet operational experience has been that considerable damage and misalignment can easily ensue upon collision or even minor nudging impact between tractor and trailer front ground legs or props or between trailer front wall and tractor cab rear wall or between tractor rear lights and trailer front ground legs. Operators suffer such damage accepting there is no realistic alternative. The responsibility for resolution by design and construction falls between truck and trailer manufacturers, neither of whom has taken the initiative, rather regarding the other element of a tractor-trailer combination as not their concern or expertise. Similarly, component suppliers, such as fifth wheel producers, have not recognised or resolved the problem.
As the fifth wheel 'setting' challenge and difficulty varies between tractor and trailer rigs, it is difficult to benefit from past experience without a 'structured' training routine and a 'compliance' check or test. Drivers may be ignorant of the issue if their operational experience has been confined to safe workable tractor-trailer combinations, so the need to check out, let alone adjust, a prospective new combination may never occur to them.

Overall, even without a 'closing the gap' (between tractor and trailer) objective or agenda, there are several interacting dimensions to keep in mind just with an anti-conflict or collision imperative. It is impractical to carry out a full relative articulation test as a cross-check upon the setting, so reassurance such as from a measurement setting up jig would be desirable.

Statement of Invention

A measurement and/or setting reference guide or gauge
for setting the position of a fifth wheel coupling
upon a tractor bed of an articulated tractor-trailer combination,
including an elongate linear marker rule or guide,
sub-divided by a series of markings, say numeric and/or colour bands,
representing indexed relative positions for relative tractor trailer disposition.

A measurement and/or setting jig
for an articulated tractor trailer combination
intercoupled by a fifth wheel turntable,
such as one mounted upon a longitudinal adjustable bed;
the jig comprising
a linear elongate measurement scale
with numeric integer and or colour-coded subdivisions
the scale being mounted upon a tractor chassis
alongside a fifth wheel turntable
an pointer arm carried upon the fifth wheel turntable aligned with the pivot axis
and hanging down the scale

A method of setting up an adjustable fifth wheel using a jig, including the steps of
taking trailer pin to front corner and rear step or leg measurements and logging them
upon a trailer placard; applying respective measurement scales to a tractor bed with
zero datum respectively from the cab rear taken rearwards and from the tractor rear
lights taken forward; with the trailer dimensions being applied to the tractor scales to
set position limits for the fifth wheel by reading the pivot axis through a pointer
hanging over the tractor bed scales.

A measurement and or setting kit,
for setting a longitudinal adjustable fifth wheel turntable bed
of an articulated tractor-trailer combination;
the kit comprising
• a set of linear scales for mounting on a tractor chassis alongside turntable bed
• trailer and tractor-cab placards
• a pointer for alignment with turntable pivot axis
• one or more measurement gauges respectively for taking co-ordinated trailer
  and tractor dimensions; including
  • a trailer pin to step or leg distance
  • a trailer pin to front corner distance
  • a tractor cab to turntable pivot axis
  • tractor rear light cluster to turntable pivot axis

An articulated tractor-trailer assembly combination,
coupled with a fifth wheel turntable,
with a set of linear scales mounted upon the tractor bed
adjacent the turntable;

one scale measuring from a rear cab wall datum backwards to turntable pivot axis
another measure from tractor chassis rear light cluster to turntable pivot axis,
a trailer placard, annotated with
- trailer pin to step or leg distance
- trailer pin to front corner distance
and a tractor placard, annotated with
- tractor cab to turntable pivot axis
- tractor rear light cluster to turntable pivot axis
a pointer on turntable bed, for alignment against the scales

Horizontal Fifth Wheel Setting

An adjustable-span fifth wheel measurement and setting gauge with end fittings adapted to locate reference points whose relative spacing is to be measured.

A fifth wheel setting gauge or guide for an articulated tractor-trailer combination comprises one or more juxtaposed reference or indexing bars, one for setting a nominally horizontal distance or spacing between a tractor cab rear wall and a fifth wheel reception or capture aperture axis, another for setting a horizontal distance between a trailer pin and the front wall of a trailer and/or forward support legs or struts; the respective setting bars being mutually offset for a prospective tractor trailer combination to allow a fifth wheel turntable platform longitudinal adjustment to a positional setting preserving operational clearance between tractor cab and trailer or tractor rear light clusters and trailer forward legs upon reversal for coupling and upon turning manoeuvring when coupled.

Atypical fifth wheel longitudinal setting range (from a setting datum) would be between circa 0.98m and 1.35m, with 50.8mm interval between subdivisions.

Vertical Setting

An optical or visual sighting guide for determining the height of a trailer top edge, in turn for setting a fifth wheel turntable height in order to bring a coupled trailer top edge to within roadway overhead clearance operational constraints.

The necessary measurement or dimensional information upon all trailer and tractor types in common use could be compiled in a master data set. The drawings of the supporting embodiments included tabulated examples. These might seem intimidating at first sight, but for intuitive visual graphic guidance in use, with a pointer and scale, from which a reading is taken for fifth wheel bed setting.

The nature, character, content, layout and disposition of reference markings - including alphanumeric, symbolic and colour coding - in such a visual guide admits of considerable variation, but some exemplary (necessarily black and white) formats are presented in the accompanying drawings for supporting embodiments.

In simpler variants of the invention, some degree of numeracy or figure work is retained. In more elaborate variants, automation or electronic computation is an option with, say, a dedicated module for input of key criteria and output of a fifth wheel setting. An intermediate graphic-led approach would be more user-friendly. A mix of symbols, numbers and graphics represents a reasonable compromise.

The Applicant envisages an 'intuitive' visual guide or bar chart. Thus prominent colour coding, such as differential colour bands or striations, (or indeed other patterns such as dots or circles) could feature upon a tractor chassis or chassis bed-mounted reference panel or table. One panel could be dedicated to horizontal or longitudinal fore-and-aft pin setting. Another, well differentiated panel could address independent vertical or height setting.

A 'combination', or dual mode, panel with twin axis graphic marking scheme might be contrived for both horizontal and vertical settings, but could prove complex and intimidating to the uninitiated, so a deterrent to adoption and usage.

Setting Jig

A setting jig for mounting alignment reference guides upon a tractor chassis bed is also envisaged to help determine forward and rearward index marks for fifth wheel setting range. A particular such jig construction features a post with a buffer to contact
the tractor rear light cluster from behind, with a side swing out arm carrying an Infra-
Red (IR) beam generator projecting forward over the tractor chassis bed.

An optical range-finder, within or working co-operatively in conjunction with, the IR
beam would allow forward measurement by a distance determined by 'below' trailer
(i.e. leg or trailer base step wall) clearance considerations. These would be calculated
from actual measurements.

A corresponding 'above' chassis bed measurement would be taken from the back of
the tractor cab rearward over the chassis bed, by a distance determined by 'above'
trailer (i.e. cab) clearance considerations.

Once the reference guides are set in place, a driver operator has simply to follow an
indicative marker, to satisfy both 'above' and 'below' clearance considerations.

An optimum setting would be one which brings the trailer front wall as close as
possible to the tractor rear wall, whilst preserving safe operational clearance during a
full turn. This to reduce drag and promote fuel economy. The invention allows a much
closer safe setting than hitherto, with significant fuel savings.

In that regard, it has been calculated that every index position in a conventional fifth
wheel adjustable bed represents a percentage point in fuel consumption.

Combination Setting Jigs - Trailer and Tractor Scale Placards

It is envisaged that the independent trailer pin-to-leg and pin-to-corner measurements
could be taken and transposed to a trailer placard using individual adapted jigs or a
combination measurement jig with end fittings adapted to contact the profiles of the
target reference points. Although a conventional measurement rule might be used,
the uncertainty or diverse profile in end points makes a bespoke jig helpful.

Similar considerations apply to the longitudinal positioning of an adjustable fifth wheel
upon a tractor chassis bed, for which a bespoke set of measurement jigs or a
combination jig could be devised. A placard recording those measurements could be
mounted adjacent the respective upper and lower forward and rearward scales,
using respective start point or zero datum.

Furthermore, a master combination jig could be contrived, capable of taking (with
manual or even automated electronic sensor) recording) and transposing all
measurements from site to placard.

Verification and Authentication

Settings could be verified by an approved setter using an authentication or
certification stamp marked on the respective trailer and tractor placards.

Cavity Infill Bag

An inflatable air (or other safe, neutral, non-volatile) bag could be deployed, say from
the back of the cab, to fill the minimally adjusted gap between cab and trailer, further
to reduce slipstream drag and bolster fuel economy.

Simulator Test or Dummy Practice Trailer Rig

Some aspects of the present invention concern a simulator or emulator rig for safe
exploratory training and practice of preparatory set-up for tractor-trailer coupling and
interaction. Thus a 'robust' and flexible solution would be desirable for use without
special skill, knowledge or undue attention or concentration.

A collapsible (e.g. quick-fold frame) such rig could be carried in the cab of a training
tractor for quick erection and use. Alternatively, a more permanent, site-specific
format could be adopted. Thus, for greater realism and effect, a full size trailer actual
or dummy rear trailer portion could be fitted with a variable-geometry profile front end
coupling.
Such a practice or test rig would present a notional trailer coupling pin, forward support legs and forward wall, to allow setting of an adjustable fifth wheel coupling turntable, preparatory to interaction with a tractor.

Fifth Wheel Height Setting

Fifth wheel height setting could be undertaken with the trailer coupled, using, say, an IR measurement beam set to shine vertical upwards respectively to fifth wheel turntable contact bed and trailer roof height. The turntable height impacts upon trailer tilt, for which excessively backward or forward lean is undesirable in terms of ride configuration and weight-shift between trailer and tractor respective rear axles.

A common setting turntable height range is from circa 1.25m to 1.26m.

Automated Setting and Coupling

Proposals have been made for automated tractor-trailer alignment and coupling of umbilical services such as air lines. These could be extended to longitudinal fifth wheel bed positioning and height setting, say from a pre-programmed control module.

Embodiments

There now follows a description of some particular embodiments of the invention, by way of example only, with reference to the accompanying diagrammatic and schematic drawings, in which:

Figures 1A through 1D show a tractor and articulated trailer combination in various successive inter-coupling stages, with relative clearance issues. More specifically ...

Figure 1A shows a plan view of a juxtaaposed tractor and trailer mutually aligned longitudinally for coupling;

Figure 1B shows a side elevation of Figure 1A;

Figure 1C shows a plan view of the coupled tractor trailer of Figures 1A and 1B, with relative (tractor front over trailer rear) end overlap and indicative relative articulation path - of which an acute condition for potential conflict arises with respective tractor and trailer axes at 45 degrees

Figure 1D shows a side elevation of the coupled tractor trailer of Figures 1A through 1C;

Figures 2A through 2B show corresponding views to Figures 1A through 1B but with a setting reference guide of the present invention fitted. More specifically ...

Figure 2A shows a plan view of a juxtaaposed tractor and trailer mutually aligned longitudinally for coupling, with a reference guide panel fitted to a tractor rear chassis bed;

Figure 2B shows a side elevation of Figure 2A;

Figure 3 shows a side elevation of a trailer side wall fitted with an information reference panel for use in conjunction with a tractor bed mounted reference guide; such a panel would be affixed to a trailer side; the size and scale could be adjusted in prominence to suit;

Figures 4A through 4D show setting reference guidance diagrams and data according to the invention. More specifically ...

Figure 4A shows a plan view of a trailer with key turntable articulation geometry;

Figure 4B shows a side elevation of Figure 4A;

Figures 5A and 5B show visual setting reference charts upon a trailer side and tractor
rear chassis bed. More specifically ...  

Figure 5A shows a side elevation of a trailer with colour coded panel of a front side wall; again scale and disposition admits of variation;  

Figure 5B shows a plan view of a tractor, with colour coded panel around the fifth wheel turntable for use with the colour trailer colour coding of Figure 5A;  

Figures 6A through 6D show alternative pattern markings to Figures 5A and 5B. More specifically ...  

Figure 6A shows a side elevation of a trailer with trailer-specific pattern markings;  

Figure 6B shows a plan view of a tractor bed with multi-trailer pattern markings, with fifth wheel coupling set for that trailer;  

Figure 6C shows a side elevation of a trailer with different trailer-specific pattern markings to those of Figure 6A;  

Figure 6D shows a plan view of a tractor bed with multi-trailer pattern markings with fifth wheel coupling set for that trailer (forward of that of Figure 6B);  

Figures 7A through 7C show variant pattern combinations to Figures 5A and 5B and Figures 6A through 6D. More specifically ...  

Figure 7A shows a side elevation of a tractor with combination reference setting pattern;  

Figure 7B shows a plan view of a tractor bed of Figure 7A with combination reference setting pattern;  

Figure 7C shows a side elevation of a trailer with combination reference setting scale patterns, reflecting pivot pin to front wall or headboard and rear floor step or setting legs;  

Figures 8A and 8B show optical reference sighting for vertical measurement and setting of fifth wheel coupling height, in turn to determine trailer head height. More specifically ...  

Figure 8A shows a side elevation of an uncoupled tractor and trailer, with an optical sight positioned alongside the tractor for gauging the height of the trailer forward top edge; a laser beam may be substituted for a passive view finder; determination of the beam elevation angle and the horizontal (i.e. over the intervening ground) distance between source and target allows trigonometric computation of the target height above ground; alternatively a laser range-finder (say, with digital readout) would give the hypotenuse distance;  

Figure 8B shows a supplementary optical laser sighting and alignment of a tractor fifth wheel and trailer pivot pin, with optional provision for distance measurement; this as a supplementary use of the vertical height measurement equipment of Figure 8A;  

Figures 9A through 9E show a collapsible, fold-away, setting reference jig for training, practice and competency test. More specifically ...  

Figure 9A shows a side elevation of a collapse folded jig resting upon the ground;  

Figure 9B shows a side elevation of a partly erected jig of Figure 9A, with vertical height adjustment of a setting bar;  

Figure 9C shows a side elevation of an extended jig of Figures 9A + 9B with forward arm deployment;  

Figure 9D shows a side elevation of the jig of Figure 9C with further extension to a setting position for horizontal reference alignment;
Figure 9E shows a side elevation of a fully operational jig of Figures 9A through 9C, ready for use;

Figures 10A through 10C shows articulated truck and trailer measurements for calculation of fifth wheel setting measurements. More specifically...

Figure 10A shows a side view of an articulated truck and trailer with various measurements marked

Figure 10B shows a plan view of a tractor turning at a 45 degree angle to its trailer, with key turntable articulation geometry marked in relation to swing clearance between the trailer front end and tractor cab;

Figure 10C shows a plan view of a tractor turning at a 45 degree angle to its trailer, with key turntable articulation geometry marked in relation to swing clearance between the tractor bed rear end and trailer stepped underside;

Figure 11A shows a plan view of a tractor turning at a 45 degree angle to its trailer with key turntable articulation geometry marked in relation to swing clearance between the tractor bed rear end and trailer stepped underside;

Figure 11B shows a table of key reference dimensions taken into account by a visual graphic setting reference guide according to the invention; key factors for consideration are shown in Figures 10A to 10D;

Figure 11C shows an articulated tractor and trailer with height adjustment scale

Figure 12 shows an articulated tractor and trailer with a via a jack under the fifth wheel casting allowing for tilt through a shallow angle.

Figure 13 shows adjustment of pneumatic suspension of tractor for height.

Figures 14A and 14B depict tractor cab to trailer front end wall operational gap considerations;

Thus, more specifically ...

Figure 14A shows re-entrant turbulent vortices induced in the tractor to trailer gap, with attendant drag;

Figure 14B depicts an inflatable bag infill option to deflect flow up around the trailer roof; this could be deployed once the gap has been minimized consistent with avoiding mutual collision;

Figures 15A and 15b depict mutual operational clearance considerations for a trailer with forward refrigeration limit; this for a trailer with lower depending ground legs at a forward end, delineating a rear travel limit for a coupled tractor unit chassis (not shown);

Thus, more specifically ...

Figure 15A depicts trailer pin to front wall corner diametral span 'C' along with longitudinal pin to front wall or headboard dimension 'B' and trailer width 'A' as inter-related factors for forward end intrusion upon trailer articulation or pivot about the pin;

Figure 15B depicts a geometrical construction of circumference of trailer corner movement art and relative tangent; a right angled triangle geometry inter-relates diagonal or hypotenuse equivalent dimension to adjacent or longitudinal axis span; thus a corner diagonal measurement can be transposed to a linear axial longitudinal distance for fifth wheel setting purposes; a tabulated chart shows example dimensions for a given trailer width;

Figure 16A through 16C depict transposition of trailer and tractor bed measurements to a placard to be mounted upon the front wall of a trailer as a permanent reminder of inter-coupling constraints to avoid collision upon coupling and relative articulation;
Thus, more specifically ...

Figure 16A shows

Figure 16B shows

Figure 16C shows

Figure 17 shows a tabulation of dimensions in relation to Figures 16A through 16B; again showing different front end settings for a given trailer width;

Figure 18 shows a juxtaposed trailer placard and trailer pin to headboard or front wall and pin to leg measurement dimensions;

Figures 19A and 19B show respective trailer and tractor placard factors in a more graphic representation for ease of visual recognition and interpretation; verification stamps are depicted for authentication of measurement dimensions;

Thus, more specifically ...

Figure 19A shows one unique distinctive pattern shading representation of pin to headboard arc dimension and another differentiated shading for legs or step frame to pin arc dimension - both with a conversion to a longitudinal span dimension, ready for fifth wheel bed adjustment upon a tractor bed also represented graphically;

Figure 19B shows a tractor chassis (or tractor cab) plate with verification stamps for authentication of measurement dimensions taken from prescribed reference (or zero) datum, for measurement scales, respectively from the tractor cab rear or rearward obstruction or extension and the rear lights; an (optional) incremental fifth wheel bed adjustment (typically some 5cm at a time) is also included; for a non-adjustable bed, the measurements are used for an initial mounting of the fifth wheel turntable upon the tractor chassis, which could incorporate an appropriate series of mounting holes;

Figures 20 through 24E show various measurement jig configurations;

More specifically ...

Figure 20 shows a dedicated trailer gauge with an elongate linear scale with a throat at one end to bear upon a trailer pin, and a sliding upright scale at the opposite end to bear upon an outboard corner of a trailer front wall or headboard; an intervening scale allows the sliding marker gauge position to be read off, as a diagonal span, with a trigonometric conversion chart for deriving a longitudinal measurement adjustment;

Figures 21A and 21B show the trailer gauge of Figure 21 deployed;

More specifically ...

Figure 21A shows a plan view of the gauge taking a corner measurement as a radius of an arc;

Figure 21B shows a side elevation of Figure 21A, with local enlargement detail of an index marker or registration for taking a scale reading;

Figure 22 shows another trailer gauge to that of Figure 20, adapted for taking a trailer pin to depending leg or drop board dimension, again as a diagonal; again with a pin yoke bearer plate at one end but with a depending bar at the opposite end and an intervening linear sub-divided measurement scale, using mutually telescopic sliding inter-fitting bar elements; an optional clamp may be fitted to hold a ready for transposition;

Figures 23A and 23B show the trailer gauge of Figure 22 in position ready for use;

More specifically ...
Figure 23A shows an underside plan view showing an arc and radius of action;

Figure 23B shows a side elevation with local enlargement detail of taking a visual scale reading of either or both along a longitudinal axis or diametrically to corners or legs if fitted;

Figures 24A through 24E show a combination gauge for both trailer measurements and with an option of both tractor bed measurements;

More specifically ...

Figure 24A shows a gauge of telescopic sliding inter-fit bars with ends set up for trailer pin to rear step wall or depending leg measurement;

Figure 24B shows the gauge of Figure 24A with scale bar removal and rotation to present an end upstand for trailer front corner measurement;

Figure 24C shows the transposed gauge of Figure 24B ready for trailer above chassis measurement;

Figure 24D shows the gauge of Figure 24C adjusted to pick up the trailer pin to front corner dimension;

Figure 24E shows the gauge turned on one side, i.e. rotated through 90 deg about its axis, to allow use as a simple measurement rule, such as for tractor bed measurement;

Figures 25A through 25C show graphically superimposition, overlay and interplay of trailer and tractor chassis bed and cab factors; in particular the upper or above chassis deck factor of trailer corner in relation to cab rear wall, allowing for relative articulation;

More specifically ...

Figure 25A shows trailer pin to trailer front wall corner diagonal dimension juxtaposed with a turntable axis to tractor cab rear wall longitudinal dimension;

Figure 25B shows the dimensions of Figure 25A superimposed with an operational clearance;

Figure 25C shows the overlay or superimposition of Figure 25B with relative articulation between tractor and trailer;

Figures 26A and 26B show trailer and tractor factors from a different standpoint of below chassis deck factors of trailer under step or depending legs in relation to tractor rear lights;

More specifically ...

Figure 26A shows the trailer pin drop board or step axial disposition transposed to the turntable axis to tractor rear light diagonal;

Figure 26B overlays the measurement factors of Figure 26A to show marginal operational clearance; the closer the better from a trailer front wall to tractor cab rear wall gap minimization, provided there remains an operating clearance between trailer front wall (or forward overhang) and cab rear wall (or rearmost obstruction).

Referring to the drawings,
Broadly, the Applicant envisages a fail-safe even fool-proof setting reference regime for the fifth wheel coupling 1 of a particular target tractor 10 trailer 11 combination. This either for an initial (fixed site) installation for a specific tractor-trailer combination or range, or ongoing adjustment where a sliding fifth wheel mounting bed is fitted;

The respective 'dimensional factors' and attendant 'measurement regime' require otherwise independent or self-contained respective trailer and tractor dimensions to be taken in conjunction to allow:

1. safe inter-couple of tractor and trailer with an intervening operational clearance at both above and below chassis deck level; and

2. minimization of trailer front wall to tractor cab rear wall (mutual collision-avoidance) operational clearance for reduction in intervening gap induced drag and thus improved fuel economy of the combination;

Fortuitously, some settings may be broadly 'compatible with' (if not optimized for) a range of trailer types, but absent an industry-wide standard applicable to all trailer variants in use or which a tractor might encounter, an object is to obviate misplaced assumptions and uncertainty by providing simple pre-prepared visual guidance without need for error-prone measurement taking, data look-up or calculation.

For a particular trailer-tractor combination a certain if not a range of fifth wheel position settings will provide safe clearance during turning. Thus, a measurement rail setting guide on a tractor chassis bed could indicate a 'safe' range for a particular trailer. An ideal or optimum position within this range could also be indicated to take into account secondary considerations such as minimizing drag.

For an articulated trailer, a key dimensional factor or consideration is pin 13 to support leg 14 spacing or pin to nearest (forward) exposed surface for potential collision, such as a step wall 17 in a trailer underside profile.

This spacing takes account of the maximum forward projection of the trailer head, including any add-on roof-mounted refrigeration unit which might otherwise be an obstruction or constraint in relation to the rear of a coupled tractor cab.

Whilst tractor-trailer collision avoidance is a primary concern, another secondary consideration is optimization of tractor-trailer spacing - that is to minimize the forward trailer end to rear cab distance, consistent with safe operational clearance at maximum relative articulation, in order to reduce drag through trailing vortices, this to help bolster fuel consumption by reducing engine effort.

Physical setting reference elements could include:

A measurement rail 20, set upon a tractor rear chassis bed 16, and starting from a definitive 'no-go' (collision conflict) area plus a 100mm safety margin clearance to allow for articulation on uneven ground to rearward movement of a fifth wheel or wheel mounting bed, with a series of measurement scale subdivisions starting with a zero marking at the front of the vehicle and then working backwards.

A companion measurement setting reference rail is mounted from the rear of the vehicle (i.e. tractor chassis), to the end of the range of fifth wheel bed travel, with a series of incremental measurement scale sub-divisions, with zero at the rearmost position and a count forward. Again a 100mm operational clearance is allowed from rear-most part of the vehicle (i.e. tractor chassis) to the nearest potential collision point on a coupled trailer, this to allow for articulation on uneven ground.

The measurement reference rails are securely fitted to the tractor chassis and are of robust material to allow for steam cleaning and heavy duty day-to-day duty. Rails of two, well-differentiated colours and/or pattern markings can be employed to allow for easy reading and interpretation for any driver operator nationality or language familiarity. An example such colour reference marking scheme would be red from front to back and blue from back to front.
The fifth wheel centre line is conveniently depicted by a small thin pointer directed downward to the paired measurement rails securely fastened and of robust material.

Fifth Wheel (Turntable) Bed Pointer - Tractor Chassis Scales

An externally mounted more prominent pointer arm could be carried upon the fifth wheel turntable aligned with the pivot axis and hanging down over twin juxtaposed (upper and lower) elongate linear scales, mounted on the tractor chassis.

These scales are conveniently differentially colour-coded, for example, red (upper / cab clearance) and blue (lower / lights clearance), respectively for the cab rear wall and rear light measurements.

The scales run from respective zero datum and measure backwards from the tractor cab rear wall and forwards from the tractor rear lights.

The trailer dimensions are also colour coded on the trailer reference placard to coordinate with the tractor dimensions.

Thus in this one example, the red colour-coded dimension is the trailer pin to trailer front corner distance; whereas the blue colour-coded trailer dimension is the trailer pin to rear step wall or depending legs measurement.

From the (colour-coded) trailer placard dimensions, applied to respective colour-coded scales mounted on the tractor chassis, the fifth wheel position pointer is set.

In practice the red transposed trailer placard figure is used as a minimum (ie the actual set position is always more); whereas the blue transposed trailer placard figure represents a maximum - which the actual setting can equal, but never exceed.

Graduated Band Colour Scale

For ease of reference a simplified colour coded scale could be substituted for the sub-divided (numeric) integer scale for both tractor chassis measurement scales.

It is envisaged that each trailer and tractor cab would be assigned a corresponding colour code, which could be more readily matched to a corresponding colour coded reference point on the setting gauge.

Various key dimensions or measurements include ...

\[ A \]

half the vehicle and/or trailer width or transverse span;

\[ B \]
pin centre-line to nearest potential contact of fouling point, such as ground legs or base step frame;

\[ C \]

\[ B \] minus 100mm,

this is the hypotenuse, from which an adjacent triangle side can be computed, being the distance from rearmost element of the tractor unit, such as the rear light cluster to the fifth wheel centre line, using an opposite of \[ A \] - which is 1.275 in the first line of the tabulated example of Figure 4C;

\[ CB = \] centre line of pin to nearest fouling point (legs or step frame)

\[ TC = \] Cab Arc which is the hypotenuse of \[ CB \] minus 100 mm. From that we work out the \[ CB \] adjacent, which is the distance from the rearmost back of the unit lights to the fifth wheel centre line using the \[ CB \] opposite of \[ A \] which is 1.275.

\[ A \] width of trailer
A 1  half width of trailer
B  distance between king pin and front of trailer
C  fifth wheel setting range, \((C1<C)>w-C2\)
C 1 front fifth wheel setting component \((d + z)\)
C 2 back fifth wheel setting component \((h + z)\)
d  minimum front swing clearance required \((V(A12 + B2))\)
E  width of tractor bed
E 1 half width of tractor bed
h  minimum back swing clearance required \((V(Y2 + E12))\)
W  length of tractor bed
X  distance between king pin and trailer legs
Y  distance between fifth wheel and end of tractor bed
z  safety / error margin

As shown in Figure 10B a 'worst case', acute or critical condition for tractor and trailer 'closeness' of juxtaposition arises with a relative orientation of trailer and tractor respective longitudinal axes at some 45 degrees. A forward outer corner of a trailer approaches a mid-cab rear wall position as shown in Figure 10B.

The maximum protrusion of the trailer edge \((d)\) from the fifth wheel coupling pivot point can be calculated from a triangle with sides of half the trailer width \((A1)\) and the distance of the pin from the trailer front end \((B)\). Therefore \((d)\) must be the minimum distance between the fifth wheel coupling pivot and the edge of the tractor cab.

In reality an additional safety margin \((z)\) would also be added to this to give the minimum distance of the tractor chassis fifth wheel setting reference point \((C1)\) from the back of the tractor cab. A parallel arc with a some 100mm additional clearance margin can be set beyond or outboard or this, if the tractor cab features a refrigeration unit this also needs to be taken into account.

An arc of movement of the tractor rear end can be plotted in relation to trailer foremost elements, such as depending legs or a trailer stepped underside as shown in Figure 10C.

Once the front reference point \((C1)\) is known, the maximum protrusion of the the tractor chassis bed back edge \((h)\) from the fifth wheel coupling pivot point can be calculated from a triangle with sides of half the tractor chassis bed width \((E1)\) and the distance between the fifth wheel coupling pivot and the back of the tractor edge \((Y)\). Therefore \((h)\) must be the minimum distance between the fifth wheel coupling pivot and the edge of the tractor chassis bed.

Again an additional an additional safety margin \((z)\) would also be added to this to give the minimum distance of the tractor chassis fifth wheel setting reference point \((C2)\) from the end of the tractor chassis bed.

Thus an acceptable fifth wheel setting reference point \((C)\) must be at least the greater of \(C1\) or \((W-C2)\).

In fact the calculations would be even more arduous, as if after a first calculation the minimum \(C1\) was found to be less than \((W-C2)\) then further calculations would be necessary as simply uprating \(C1\) would affect the \(Y\) measurement and \(C2\) would need to be recalculated.
More advanced trigonometric calculation could determine an optimum modelling
would then given a optimum point, but simplistically this would be as close to a
minimum C1 as possible.

In Fig 1OC example it is assumed that the front most collision point on the trailer
underside is a stepped edge. An alternative scenario would be outboard trailer legs
being set further forward. Yet as these would only be at the edges of the trailer the
arc of swing of the tractor bed chassis would need to be computed as different
triangulation applies.

If the fifth wheel cannot be adjusted sufficiently, i.e. the adjustment range or indexed
sub-division is limited, the next indexed setting position 'away from the collision
danger range' (i.e. increasing the tractor-trailer spacing with a more rearward
turntable bed position) is adopted.

Figures 4A and 4B reflect operational clearance demands and setting safeguards for
a trailer foremost projection wall or wall-mounted element, such as a refrigerated
trailer with a forward head mounted refrigeration unit close to a tractor cab rear wall.

Figure 4C tabulates a range of measurement values of A1, B and C with
trigonometric calculation factors. Figure 4D tabulates the calculation outcome.

Reference Panel Variation

Due to the number of variants and complex calculation required, it is proposed in the
present invention to present the outcome in a simplified visual reference guide or
measuring rail on the tractor chassis bed. Thus no manual calculation is needed and
a particular tractor trailer combination can be looked up and required scale or 'colour-
code' easily obtained.

The particular shape and configuration of reference panels and indeed the panel
content and layout are adaptable to circumstances, that is the operating room
available without interference with relatively moving elements. Thus tailored panels
could be designed for particular tractor and trailer types. The setting panels use a
common master measurement scheme, so are of universal applicability once fitted.
No prior knowledge of particular dimensions is a prerequisite, but merely (colour
vision defects aside) an ability to recognise and match colour and/or colour patterns.
Absent such provision according to the invention a driver-operator is faced with
labourious and time-consuming measurement and marking of uncertain outcome.

Simulator and Test Rig

Figures 7A through 7E depict a simulator and test rig construction and operation.

Collapse-Fold Gauge

A compact linearly-retractable, even collapse-folding, gauge or setting jig is
convenient for ease of transport and storage - even within a tractor cab for on-site
testing and practice.

For manual use, a careful written note must be taken of each measurement reading
for precise recordal upon tractor and trailer placards or plaques, with an embedded
safety margin.

It is envisaged that trained and tested fitters would install, verify or self-certify and
annotate (with an embossed, engraved or indelible marking) either or both trailer and
tractor placards and that driver-operators would learn how to apply the authenticated
placard readings to fifth wheel bed positioning - and in particular to minimize the safe
operational clearance for minimal cab wall trailer wall intervening gap.

A multi-role or convertible measurement gauge could also feature provision for
separately recording and transposing individual measurement readings. A
demountable electronic recording transducer - say, with printer output option - could
be adopted for this purpose. This could encode and log all the placard certifications
undertaken as an audit trail. A portable PC or personal organiser could be adapted for this purpose and linked wirelessly to a central database.

Supplementary placards or annotations could reflect both a safe operational clearance and a minimized trailer to tractor wall intervention gap for reduced drag.

5 Colour-coded King Pin

In order to reduce the numeric or arithmetic challenge of relating trailer and tractor dimensions or constraints, an extended colour coded alternative system might be adopted in which broad tractor-trailer compatibility is reflected in a colour code.

Thus, for example a colour coded trailer king pin might be used; with tractor placard similarly colour coded to reflect compatibility of tractor and trailer, from a prime consideration of obviating trailer front wall to tractor rear cab conflict.

This leaves only the tractor rear light cluster clearance to be determined by use of a measurement scale in relation to a placarded trailer dimension of pivot pin to trailer legs or understep.

15 This simplifies the task of assessing tractor-trailer compatibility; and provides safe operating bounds along with a more immediate colour guidance code.
Component references

10  tractor cab
11  trailer
12  fifth wheel plate
13  king pin
14  trailer legs
15  fifth wheel coupling
16  tractor bed
17  trailer stepped underside

20  setting reference guide
21  tractor cab information reference panel
22  trailer colour coded reference guide
23  tractor bed colour coded reference guide
24  tractor bed combination reference guide
25  trailer combination reference guide
26  alignment reference marker

30  optical sight
31  laser
32  laser
33  laser beam
34  ground

A  width of trailer
A1  half width of trailer
B  distance between king pin and front of trailer
C  fifth wheel setting range, \((C1 < C > W - C2)\)
C1  front fifth wheel setting component \((d + z)\)
C2  back fifth wheel setting component \((h + z)\)
d  minimum front swing clearance required \((V(A12 + B2))\)
E  width of tractor bed
E1  half width of tractor bed
h  minimum back swing clearance required \((V(Y2 + E12))\)
W  length of tractor bed
X  distance between king pin and trailer legs
Y  distance between fifth wheel and end of tractor bed
z  safety / error margin
Claims

1. A measurement and/or setting reference guide or gauge for setting the position of a fifth wheel coupling upon a tractor bed of an articulated tractor-trailer combination, including an elongate linear marker rule or guide, sub-divided by a series of markings, say numeric and/or colour bands, representing indexed relative positions for relative tractor trailer disposition.

2. A gauge of Claim 1, with measurement scales for associated trailer and tractor dimensions, including, on the one hand, upper or above chassis factors, such as a distance between trailer front wall, including any projections, and tractor cab rear wall and any rear projections; and, on the other hand, lower or below chassis factors, such as a tractor cab chassis rear end and trailer underside legs or base step wall; the scales carrying a reference index for reading the overall extended gauge span, as an indicator of fifth wheel position consistent operating clearance between tractor and trailer.

3. A gauge of either preceding claim, for setting both trailer measurement factors, that is diagonal span of pin to leg and pin to front corner extremities; the scale comprising a graduated (say linear) scale of adjustable span, with a reference index marker for scale reading, to reflect the scale extension outer span limits, with opposite end abutment and registration plates adapted to locate upon the respective extremity profiles.

4. A scale of any preceding claim for setting both tractor measurements that is respectively turntable axis to rear light cluster and rear cab wall.

5. A master combination gauge for setting both trailer and tractor measurements, comprising the gauges or gauge elements of any preceding claims consolidated into a single composite measurement arm, with universal adaptable or changeable end points and individual or multiple scale subdivisions adapted accordingly.

6. A gauge of any preceding claim adapted for configuration of minimal spacing between tractor and trailer above chassis portions for reduced induced or form drag and in turn optimal fuel economy, the scales reflecting either or both the working clearance limits in conjunction with an absolute minimum tractor cab rear to trailer front wall spacing.

7. A measurement and/or setting jig for an articulated tractor trailer combination intercoupled by a fifth wheel turntable,
such as one mounted upon a longitudinal adjustable bed; the jig comprising
a linear elongate measurement scale
with numeric integer and or colour-coded subdivisions
the scale being mounted upon a tractor chassis
alongside a fifth wheel turntable
an pointer arm carried upon the fifth wheel turntable aligned with the pivot axis
and hanging down the scale

8. A measurement jig of Claim 7,
with a plurality of differentially colour-coded scales, for example, red (upper / cab
clearance) and blue (lower / lights clearance), respectively for the cab rear wall and
rear light measurements; the scales being set to run from respective zero datum and
measure backwards from the tractor cab rear wall and forwards from the tractor rear
lights; the trailer dimensions also being colour coded on a trailer reference placard to
co-ordinate with the tractor dimensions.

9. A measurement jig of Claim 8, wherein one, say red, colour-coded dimension is used
for a trailer pin to trailer front corner distance; whereas another, say blue, colour-
coded trailer dimension is the trailer pin to rear step wall or depending legs
measurement; from the (colour-coded) trailer placard dimensions, applied to
respective colour-coded scales mounted on the tractor chassis, the fifth wheel
position pointer can be set; in practice the one, say red, transposed trailer placard
figure is used as a minimum (ie the actual set position is always more); whereas the
other, say blue, transposed trailer placard figure represents a maximum - which the
actual setting can equal, but never exceed.

10. A measurement jig of Claim 7,
with a graduated band colour scale;
unique to each trailer and tractor cab combination.

11. A method of setting up an adjustable fifth wheel using a jig of any of Claims 6 through
10 including the steps of taking trailer pin to front corner and rear step or leg
measurements and logging them upon a trailer placard; applying respective
measurement scales to a tractor bed with zero datum respectively from the cab rear
taken rearwards and from the tractor rear lights taken forward; with the trailer
dimensions being applied to the tractor scales to set position limits for the fifth wheel
by reading the pivot axis through a pointer hanging over the tractor bed scales.

12. An articulated tractor-trailer assembly combination,
coupled with a fifth wheel turntable,
fitted with a setting gauge of any of Claims 1 though 6;

13. A measurement and or setting kit,
for setting a longitudinal adjustable fifth wheel turntable bed
of an articulated tractor-trailer combination ; the kit comprising
• a set of linear scales for mounting on a tractor chassis alongside turntable
  bed
• trailer and tractor-cab placards
• a pointer for alignment with turntable pivot axis
• one or more measurement gauges respectively for taking co-ordinated trailer
  and tractor dimensions; including
  • a trailer pin to step or leg distance
  • a trailer pin to front corner distance
15. An articulated tractor-trailer assembly combination, coupled with a fifth wheel turntable, with a set of linear scales mounted upon the tractor bed adjacent the turntable:

- one scale measuring from a rear cab wall datum backwards to turntable pivot axis
- another measure from tractor chassis rear light cluster to turntable pivot axis,

a trailer placard, annotated with

- trailer pin to step or leg distance
- trailer pin to front corner distance

and a tractor placard, annotated with

- tractor cab to turntable pivot axis
- tractor rear light cluster to turntable pivot axis

a pointer on turntable bed, for alignment against the scales
AMENDED CLAIMS

received by the International Bureau on 27 October 2008

Original Claims 1 through 14 stand.

Supplementary Claims

15. An articulated tractor with an adjustable fifth wheel upon a chassis bed fitted with a pair of elongate longitudinal scales set respectively to end datum of or related to the rear of a tractor cab or cab rearmost overhang and the tractor rear lights.

16. An articulated trailer fitted with a placard marked with coupling dimensions, including a coupling pin forward to trailer front corner or foremost overhang and a coupling pin rearward to front legs or a depending skirt. b allow setting of an adjustable fifth wheel of a coupled tractor b clear both the tractor rear lights and rear cab or rearmost overhang.

17. An articulated tractor of Claim 15 in coupled combination with an articulated trailer of Claim 16, with a trailer coupling pin fitted into an adjustable fifth wheel bed set to trailer coupling dimensions.

18. A coupled tractor and trailer combination of Claim 17, with a fifth wheel positioned consistent both with trailer coupling dimensions and to achieve a minimum operational distance between cab rear and trailer front b reduce drag.

19. A method of setting an adjustable fifth wheel of an articulated tractor and trailer combination of Claims 17 or 18, comprising the steps of taking and applying the trailer coupling dimensions of Claim 16 to respective scales upon the tractor fifth wheel chassis bed and adjusting the bed longitudinal position when tractor and trailer are coupled and the bed unlocked until a setting consistent with both trailer dimensions is achieved and also to minimise the operational gap between front of trailer and rear of tractor cab and then locking the bed position.

20. A measurement gauge, tool or jig for taking a trailer coupling dimensions of Claim 16, the gauge comprising one or more adjustable span or extensible arms with a scale to read off the extended span for recording, such as upon a trailer placard, and/or transposition to a corresponding scale set upon an adjustable fifth wheel chassis bed of a tractor.

21. A set of elongate measurement scales or rules with subdivisions consistent with trailer coupling dimensions of Claim 16 transposed to the scales. With datum set as in Claim 15 and related b tractor rear lights and tractor cab rear wall or rearmost overhang and subdivided over a range of fifth wheel adjustment positions

22. A method of setting up measurement scales upon a tractor bed with respective datum related b tractor cab rear and tractor rear lights, with an adjustable span gauge arm with one end touching a datum and extending along the tractor chassis bed to embrace a range of adjustment.
23. A method of setting up measurement scales of Claim 22, wherein tractor cab is used as an over-riding limiting factor.

24. A method of characterising or identifying an articulated trailer for coupling purposes by reference, either explicitly or encoded, to two key coupling dimensions of Claim 16 and a trailer characterised thereby.

25. An adjustable fifth wheel coupling for the tractor of Claim 15 fitted upon a chassis bed with measurement scales set up according to Claim 22, with a depending pointer arm aligned with the coupling pivot axis and towards or over the scales.
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<th>B = Pin to H/board</th>
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Figure 17
Figure 19A

Pin - Headboard ARC = [measure]
cms
Pin - Legs/Step Frame ARC = [measure]
cms

© STOP-GAP™ TRAILER DIMENSION PLATE

Figure 19B

Slider Movement if fitted = [measure]
cms

Fifth-wheel - Cab = [measure]
cms
Lights - Fifth-wheel = [measure]
cms

© STOP-GAP™ CAB DIMENSION PLATE
# INTERNATIONAL SEARCH REPORT

**INTERNATIONAL APPLICATION NUMBER**

INTERNATIONAL SEARCH REPORT PCT/GB2008/050368

**A. CLASSIFICATION OF SUBJECT MATTER**

INVE. B62D53/08 G01B5/14 B62D35/00

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)

B62D G01B

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

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

EPO-Internal

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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**X1** Further documents are listed in the continuation of Box C.

**X** 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
- **P1** document published prior to the international filing date but later than the priority date claimed

**Date of the actual completion of the international search**

4 August 2008

**Date of mailing of the International search report**

26/08/2008

Name and mailing address of the ISA/

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Authorized officer

Rin chard, Laurent
## DOCUMENTS CONSIDERED TO BE RELEVANT

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