2024:MHC:1951

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IN THE HIGH COURT OF JUDICATURE AT MADRAS

Judgment reserved on	22.12.2023
Judgment pronounced on	30.04.2024

CORAM:

THE HON'BLE MR. **JUSTICE SENTHILKUMAR RAMAMOORTHY**

(T) CMA (PT) No.17 of 2023

[OA/59/2020/PT/CHN]

1. Pinnacle Engines Inc.
   1300 Industrial Suite 1A, San Carlos,
   California-94070, USA.

2. TVS Motor Company Limited
   Jayalakshmi Estate,
   24 (Old No.8), Haddows Road,
   Chennai-600006 ... Appellants

v.

The Assistant Controller of Patents & Designs,
The Patent Office,
Intellectual Property Office Building,
G.S.T.Road, Guindy,
Chennai-600 032. ... Respondent

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PRAYER IN (T)CMA(PT)/17/2023: This Civil Miscellaneous Appeal filed under Section 117-A of the Patents Act, 1970, to allow the present appeal and set aside the impugned order of the Assistant Controller of Patents & Designs dated 24.09.2020 in 8612/CHENP/2012 and hold that the pending claims are valid and involve an inventive step; and to direct the Controller to grant the patent.

For Appellants : Ms.Vindhya S. Mani
Mr.Kiran Manokaran
for M/s.Lakshmikumaran & Sridharan

For Respondent : Mr.S.Diwakar, SPC

JUDGMENT

Background

The appellants challenge an order dated 24 September 2020 by which Application No.8612/CHENP/2012 was rejected.

2. The appellants filed the above mentioned application for grant of patent in respect of an invention titled "OPPOSED PISTON ENGINE WITH NON-COLLINEAR AXES OF TRANSLATION" by

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specifying 15 April 2011 as the priority date. The claimed invention relates to internal combustion engines, and more specifically to opposed piston engines in which a combustion volume chamber is at least partially defined by piston head crowns of two opposed pistons that reciprocate along axes of translation within two cylinder bores that are inclined relative to one another.

3. The prior art disclosed internal combustion engines comprising opposed piston engines with collinear cylinder bores and a common axis of translation along which the pistons reciprocate. In engines with a small displacement volume, space for placement of one or more ignition elements in the connecting piece may not be available between the piston crowns at the top dead center position of the pistons. A fully collinear configuration of the opposed pistons would also result in the engine requiring substantial width to accommodate the offset through bearings and the respective crankshafts positioned outboard of the bottom dead center position

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of each of the opposed pistons. Such engines are generally longer than non-opposed piston engines of comparable displacement volume because of the end-to-end orientation of the cylinder bores and hence can be bulky. The presence of two crankshafts near the outboard ends of the respective cylinder bores can increase the weight of the engine at least because structural elements having significant size and weight would also be necessary to support the two crankshafts and to transfer the motion of the opposed pistons to a vehicle drive shaft via a drive train or other mechanism linking the two separate crankshaft assemblies. Besides, the packaging of an opposed piston engine having collinear cylinder bores and a common axis of translation along which the pistons reciprocate is usually done in a way that the central axis of the engine is almost parallel to the central axis of the vehicle. As a consequence, engine oil in certain parts of the engine may not flow under the effect of gravity. Stagnation of oil can also occur at the bottom of the pistons due to the packaging and orientation of the engine in the vehicle.

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4. The claimed invention seeks to address these and other issues in currently available solutions. Towards that end, it discloses an opposed piston engine configuration in which the two opposed pistons that form part of a combustion chamber do not share a common, for example collinear, axes of translation. Instead, unlike a conventional opposed piston engine in which the axes along which the two opposed pistons are translated during their reciprocating motion are collinear, in the implementation of the current subject matter, the two axes are inclined relative to each other at an angle that is greater than 0° and smaller than 180°, and such angle can be measured in a plane defined by the axis of translation of the two opposed pistons. Since the two axes of translation form an inverted "V", there is a larger area at the top of the combustion chamber to provide for one or more spark plugs or other ignition elements. As amended, the independent claims of the claimed invention envisage a first crank offset between the first piston and the first crankshaft

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and a second crank offset between the second piston and the second crankshaft, thereby lowering the load on joints between the pistons and the rubbing of the pistons with the cylinder wall during engine operation. The amended claims also disclose that the crankshafts rotate in opposite directions and the complete specification recites that this reduces vibrations.

5. The application for patent was filed on 8 October, 2012. The complete specification comprised claims 1 to 24 (original set of claims). The application was published on 14 February, 2014. Pursuant to a request for examination, the first examination report (FER) was issued on 7 December, 2018. The substantive objection raised in the FER was lack of inventive step in view of cited documents JP 2006152952(A) (D1), JPH04116231(A) (D2), US 4554894A (D3), US 2105272(A) (D4) and US 7234423(B2) (D5). The FER was responded to on 7 June, 2019. While responding, the appellant amended and renumbered the claims as claims 1 to 20 (first

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amended set of claims). Thereafter, the hearing was held on 10 July, 2020. The hearing notice reiterated the objections raised previously in the FER. The appellants filed written submissions on 24 July, 2020 along with the current claims and the impugned order was issued in these facts and circumstances on 24 September, 2020.

Counsel and their contentions

6. Oral arguments on behalf of the appellants were advanced by Ms. Vindhya Mani, learned counsel, and on behalf of the respondents by Mr. S. Diwakar, learned SPC.

7. Learned counsel for the appellants submitted that the prior art consisted of inverted pistons with a collinear shaft. By pointing out that such conventional opposed pistons resulted in a bulky engine, caused packaging problems, and fuel leakage, she contended that the solution envisaged by the claimed invention saves space. More importantly, she pointed out that the crank offset reduces

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friction. According to learned counsel, prior arts D1, D3 and D5, which were the prior art documents relied on in the impugned order, do not disclose one or more of the features recited in amended independent claim 1. With specific reference to D1, she pointed out that D1 discloses a reciprocating engine of good fuel economy by reducing cooling loss in a small size 2 stroke engine for a passenger vehicle. Towards this end, opposed piston -type two-stroke cycle engine with bench-shaped cylinders are provided. According to her, the technical advance of D1 is increased fuel economy because the TDC combustion chamber wall area is reduced by half as compared to a four stroke engine by adopting the structure of D1. As a result, cooling loss is reduced by 35 to 40%. However, learned counsel pointed out that D1 does not disclose that a first crank offset is provided between the first piston and the first crankshaft, and that a second crank off set is provided between the second piston and the second crank shaft. Further, she submitted that D1 does not disclose that the rotation of the first crankshaft and second crankshaft are in

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opposite directions.

8. Turning to D3, she submitted that D3 discloses an internal combustion engine with opposed cylinders defining a central combustion chamber. In D3, she submitted that a pair of crankshafts are positioned outwardly to the respective cylinders by a distance which allows the pistons and connecting rods to be withdrawn from the bottoms of the cylinders, when disconnected from the crankshafts, without interference from the crankshafts. The cylinders are inclined to the horizontal and define a substantially "V" shaped combustion chamber. As in the case of D1 and D2, she contended that D3 does not disclose that a first crank offset is provided between the first piston and the first crankshaft, and a second crank offset is provided between the second piston and the second crankshaft. Further, she submitted that D3 does not disclose that the rotation of the first and second crankshafts are in opposite directions.

9. With regard to D5, she submitted that it describes an internal

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combustion engine having reciprocating piston sleeves that comprise an engine block with a pair of cylinders with each cylinder having an intake port, an exhaust port and two linear opposing pistons connecting to two opposing crankshafts. In D5, she submitted that a pair of piston sleeves are reciprocating in each cylinder, one piston sleeve around each piston. Each piston sleeve is connected to one of two eccentric shafts that run parallel and adjacent to each crankshaft. The piston sleeves have ported slots in communication with either the intake ports or the exhaust ports of each cylinder. The eccentric shafts are mechanically connected to the crankshafts such that they move in unison. As in the case of D1 and D3, she contended that D5 does not disclose that a first crank offset is provided between the first piston and the first crankshaft, and a second crank offset is provided between the second piston and the second crankshaft. Besides, she contended that D5 does not disclose that the rotation of the first and second crankshafts are in opposite directions.

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10. Learned SPC countered the above submissions. According to him, the claimed invention would be obvious to the person skilled in the art on the basis of cited prior art. He contended that D3 is the closest prior art. By pointing out that D3 discloses an internal combustion engine with a design aimed to increase efficiency, he submitted that it provides for opposed cylinders inclined to horizontal, forming a V shaped combustion chamber. By pointing out that D3 discloses a pair of crankshafts positioned outwardly of the respective cylinders in such a manner as to allow the pistons and connecting rods to be withdrawn from the bottoms of the cylinders, when disconnected from the crankshafts, without interference from the crankshafts, he submitted that it solves the same problem as the claimed invention. Likewise, by referring to prior art D5, he contended that it describes an internal combustion engine having reciprocating piston sleeves. He further submitted that the engine block in D5 comprises a pair of cylinders and that each cylinder has

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an intake port, an exhaust port and two linear opposing pistons connected to opposing crankshafts. Each piston sleeve is connected to one of two eccentric shafts that run parallel and adjacent to each crankshaft. The eccentric shafts and the crankshafts move in unison. As in the case of D3, he contended that D5 also solves the same problem as the claimed invention. He concluded his submissions by pointing out that the appellants applied for the grant of patent before the US patent office and the China patent office, but subsequently abandoned the applications in the face of objections by the patent offices.

Discussion, analysis and conclusions

11. In order to examine whether the claimed invention involves an inventive step, it is necessary to refer to the sequence of material events relating to the prosecution of the patent application. The appellants filed claims 1-24 with the patent application. Out of these, I set out the original independent claims 1 and 13 and material

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dependent claims 6, 7, 18 and 19, which were as under:

"1. An opposed piston internal combustion engine comprising: a first piston reciprocating along a first axis of translation within a first cylinder bore in an engine block, the first piston reciprocating between a first top dead center position and a first bottom dead center position, the first piston comprising a first piston crown ;

a first crankshaft configured to be rotated under influence of the reciprocating of the first piston, the first crankshaft disposed close to the first bottom dead center position than to the first top dead center position;

a second piston reciprocating along a second axis of translation within a second cylinder bore in the engine block, the second piston reciprocating between a second top dead center position and a second bottom dead center position, the second axis of transaction being inclined at an included angle relative to the first axis of transaction, the included angle having a vertex that is closer to the first and the second top dead center positions than to the first and the second bottom dead center

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positions, the second piston comprising a second piston crown, the second piston crown and the first piston crown at least partially defining a combustion chamber within the opposed piston internal combustion;

and a second crankshaft configured to be rotated under influence of the reciprocating of the second piston, the second crankshaft disposed closer to the second bottom dead center position than to the second top dead center position.

6. An opposed piston internal combustion engine as in any of claims 1 to 5, further comprising: a first sleeve valve associated with the first piston to control opening and closing of an inlet port for allowing delivery of at least one of fuel and air to the combustion chamber, the first sleeve valve at least partially encircling the first piston in the first bore and configured to move at least in a direction parallel to the first axis of translation such that in a first close position the first sleeve valve is configured to be urged into contact with the first valve seat.

7. An opposed piston internal combustion

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engine as in any of claims 1 to 6, further comprising: a second sleeve valve associated with the second piston to control the opening and closing of an exhaust port for allowing removal of combustion gases from the combustion chamber, the second sleeve valve at least partially encircling the second piston in the second bore and moving at least in a direction parallel to the second axis of translation such that in a second close position the second sleeve valve is urged into contact with the second valve seat;

13. A method comprising: reciprocating a first piston between a first top dead center position along a first axis of translation within a first cylinder bore in an engine block of an opposed piston internal combustion engine, the first piston comprising a first distant crown ;

rotating the first crankshaft under influence of the reciprocating of the first piston, the first crankshaft disposed closer to the first bottom dead center position than to the first top dead center position;

reciprocating a second piston between a

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second top dead center position and a second bottom dead center position along a second axis of translation within a second cylinder bore in the engine block, the second axis of translation being inclined at an included angle relative to the first axis of translation, the included angle having a vertex that is closer to the first and the second top dead center position is than to the first and second bottom dead center positions, the second piston comprising a second piston crown, the second piston crown and the first piston crown at least partially defining a combustion chamber within the opposed piston internal combustion engine; and

rotating a second crankshaft under influence of the reciprocating of the second piston, the second crankshaft disposed closer to the second bottom dead center position than to the second top dead center position.

18. A method as in any of claims 13 to 17, wherein the first sleeve valve is associated with the first piston to control opening and closing of an inlet port for allowing delivery of at least one of

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fuel and air to the combustion chamber, the first sleeve valve at least partially encircling the first piston in the first bore and moving at least in a direction parallel to the first axis of translation such that in the first closed position the first sleeve valve is urged into contact with the first valve seat.

19. A method as in any of claims 13 to 18, wherein a second sleeve valve is associated with a second piston to control the opening and closing of an exhaust port for allowing removal of combustion gases from the combustion chamber, the second sleeve valve at least partially encircling the second piston in the second bore and moving at least in a direction parallel in the second axis of translation such that in a second enclosed position the second sleeve valve is urged into contact with the second valve seat."

12. Upon publication on 14 February 2014, followed by request for examination dated 01 April 2014, the FER was issued on 07 December 2018. As is evident from the original claims set out above,

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the two features emphasised by learned counsel for the appellants as establishing inventive step: (i) the provision of a crank offset between the first piston and the first crankshaft and, likewise, the provision of a crank offset between the second piston and the second crankshaft; and (ii) the rotation of the two crankshafts in opposite directions, were not claimed in the original set of claims. It is also noticeable that such crank offset is not seen in the drawings forming part of the complete specification, such as Figures 2 and 5. In the FER, as mentioned earlier, in the context of the original set of claims set out above, objections were raised *inter alia* on the ground of lack of inventive step by citing prior arts D1-D5. In response, the appellants amended the original set of claims by merging original claims 6 and 7 with original independent claim 1 and similarly merging original claims 18 and 19 with original independent claim 13. Consequently original claims 6, 7, 18 and 19 were deleted and the claims were renumbered as claims 1-20. It is pertinent to point out that, even at this stage, the claims were not amended to include the crank offset or

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the crankshaft rotation features discussed above.

13. In response, by hearing notice dated 10 June 2020, the same objections were maintained in view of the same prior art (D1-D5). After the oral hearing, along with the written submissions, the current claims were filed by amending independent claims 1 and 11. The changes were by way of incorporation of the crank offset and crankshaft rotation features. The crank offset and the crankshaft rotation features were, however, contained in paragraph [0049] of the complete specification as an option. Current independent claims 1 and 11 are set out below by emphasising in bold font the changes:

> *"1. An opposed piston internal combustion engine (200, 300, 400, 500) comprising:*
>
> *a first piston (104) reciprocating along a first axis of translation (202) within a first cylinder bore (502) in an engine block, the first piston (104) reciprocating between a first top dead center position and a first bottom dead center position, the first piston (104) comprising a first piston crown (102);*

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a first crankshaft (136) configured to be rotated under influence of the reciprocating of the first piston, the first crankshaft (136) disposed close to the first bottom dead center position than to the first top dead center position; and

a first sleeve valve (122) associated with the first piston (104) to control opening and closing of an inlet port (116) for allowing delivery of at least one of fuel and air to the combustion chamber (114), the first sleeve valve (122) at least partially encircling the first piston (104) in the first bore and configured to move at least in a direction parallel to the first axis of translation (202) such that in a first close position the first sleeve valve (122) is configured to be urged into contact with the first valve seat (128); a second piston (110) reciprocating along a second axis of translation (204) within a second cylinder bore (504) in the engine block, the second piston (110) reciprocating between a second top dead center position and a second bottom dead center position, the second axis of translation (204) being inclined at an included angle relative to the first axis of

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translation, the included angle having a vertex that is closer to the first and the second top dead center position is than to the first and second bottom dead center positions, the second piston (110) comprising a second piston crown (106), the second piston crown (106) and the first piston crown (102) at least partially defining a combustion chamber (114) within the opposed piston internal combustion engine;

a second crankshaft (138) configured to be rotated under influence of the reciprocating of the second piston (110), the second crankshaft (138) disposed closer to the second bottom dead center position that the second top dead center position; and

a second sleeve valve (124) associated with the second piston (110) to control the opening and closing of an exhaust port (120) for allowing removal of combustion gases from the combustion chamber (114), the second sleeve valve (124) at least partially encircling the second piston (110) in the second bore and moving at least in a direction parallel to the second axis of translation

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(204) such that in a second close position the second sleeve valve (124) is urged into contact with the second valve seat (130);

wherein a first crank offset is provided between the first piston (104) and the first crank shaft (136), and a second crank offset is provided between the second piston (110) and the* second *crankshaft (138), wherein, by the provision of the first crank offset and the second crank offset, the first crank offset (136) and the second crankshaft (138) are rotatable in opposite directions.

11. A method comprising:

reciprocating a first piston (104) between a first top dead center position Along a first axis of translation (202) within a first cylinder bore (502) in an engine block of an opposed piston internal combustion engine, the first piston (104) comprising a first piston crown (102);

rotating the first crankshaft (136) under influence of the reciprocating of the first piston, the first crankshaft (136) disposed closer to the first bottom dead center position that the first top dead center

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position, wherein the first sleeve valve (122) is associated with a first piston (104) to control opening and closing of an inlet port (116) for allowing delivery of at least one of fuel and air to the combustion chamber (114), the first sleeve valve (122) at least partially encircling the first piston (104) in the first bore and moving at least in a direction parallel to the first axis of translation (202) such that in the first closed position the first sleeve valve (122) is urged into contact with the first valve seat (128);

reciprocating a second piston (110) between a second top dead center position and a second bottom dead center position along a second axis of translation (204) within a second cylinder bore (504) in the engine block, the second axis of translation (204) being inclined at an included angle relative to the first axis of translation, the included angle having a vertex that is closer to the first and the second top dead center position is that the first and second bottom dead center positions, the second piston (110) comprising a second piston crown (106), the second piston crown (106)

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and the first piston crown (102) at least partially defining a combustion chamber (114) within the proposed piston internal combustion engine; and

rotating a second crankshaft (138) under influence of the reciprocating of the second piston (110), the second crankshaft (138) disposed closer to the second bottom dead center position than to the second top dead center position, wherein a second sleeve valve (104) is associated with a second piston (110) to control the opening and closing of an exhaust port (120) for allowing removal of combustion gases from the combustion chamber (114), the second sleeve valve (104) at least partially encircling the second piston (110) in the second bore and moving at least in a direction parallel to the second axis of translation (204) such that in a second enclosed position the second sleeve valve (104) is urged into contact with the second valve seat (130);

wherein a first crank of set is provided between the first piston (104) and the first crankshaft (136), and a second crank of set is provided between the second piston (110) and

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the second crankshaft (138) wherein, by the provision of the first crank offset and the second crank offset, the first crankshaft (136) and the second crankshaft (138) are rotatable in opposite directions." [emphasis added]

14. The impugned order was pronounced in these facts and circumstances. After discussing prior arts D1, D3 and D5, the operative portion of the impugned order is as under:

> *"With it is the basic design change item which it easily can work out it is recognised to the normal technical engineer to form the opposed piston internal combustion engine which comprises "a first crankshaft, a first sleeve valve, a second piston, a second crankshaft, a second sleeve valve." Therefore, claims 1 and 11 invention can be invented by the normal technical engineer based on the cited invention.*
>
> *Hence the present invention lacks inventive step according to section 2(1)(ja) of The Patents Act, 1970 and a person skilled in the art will be motivated by the above cited documents to*

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conclude the invention."

15. In the above extract, the Assistant Controller merely set out the various elements of the claimed invention such as the opposed pistons, the two crankshafts and the two sleeve valves and proceeded to record the conclusion that the claimed invention would be obvious to a normal technical engineer based on cited prior arts. I find no analysis or discussion of the features of the claimed invention, including with regard to the provision of a crank offset between the first piston and the first crankshaft and likewise between the second piston and the second crankshaft or the rotation of the two crankshafts in opposite directions. Consequently, the impugned order is effectively unreasoned and cannot be sustained.

16. The question that follows is whether the matter should be remanded after setting aside the impugned order or whether the patent application should be directed to proceed to grant. Before drawing conclusions, the prior art should be discussed. Prior art D1

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is an invention titled "New Opposed Piston Type Two Stroke Cycle Engine". From paragraph [0002] of the complete specification, it appears that the solution claimed and disclosed therein is the prevention of cooling loss at low and medium speed operation. As in the case of the claimed invention, it is clear from Figure 1 therein that the two cylinders and pistons are inclined downward from the combustion chamber, thereby creating a larger combustion chamber without using the larger space that would have been required to form an equal sized combustion chamber if the cylinders and pistons were not inclined relative to the combustion chamber. The crank offset and crankshaft rotation features are, however, neither claimed nor shown in the drawings forming part of D1.

17. D3 is an invention titled "Twin-Piston-Per Cylinder Engine". Since D3 was cited as the closest prior art, I set out below the summary, in relevant part:

".... In a preferred form of the invention, the

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cylinders may be disposed in generally horizontally opposed relation inclined slightly downwardly away from the common combustion chamber. This provides an effective combustion chamber design with minimum piston clearance at the bottom of the chamber while allowing ample room at the top of the chamber for a spark plug (in an S.I. engine) and inlet and exhaust valves...."

When this is compared with paragraphs [0030] and [0031] of the complete specification of the claimed invention, there is similarity in the design of the cylinders, pistons and the common central combustion chamber defined by these elements. However, as contended by learned counsel for the appellant, Figures 1 and 3 of D3 show that the crankshaft is aligned with the cylinders and not off set. D5 describes an internal combustion engine having reciprocating piston sleeves that comprise an engine block with a pair of cylinders with each cylinder having an intake port, an exhaust port and two linear opposing pistons connecting to two opposing crankshafts. In D5, a pair of piston sleeves are reciprocating in each cylinder, one

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piston sleeve around each piston. Each piston sleeve is connected to one of two eccentric shafts that run parallel and adjacent to each crankshaft. As in the case of D3, from Figures 8 and 9 of D5, it appears that the crankshaft is aligned with the cylinders and not off set.

18. Thus, as regards the crank offset and rotation of crankshaft features, these features are not found in D1, D3 & D5. There is no teaching, suggestion or motivation either in D1, D3 & D5 that would make these features obvious to a person skilled in the art. Nonetheless, as discussed earlier, independent claims 1 and 11 were modified to incorporate these features at the written submissions stage after the oral hearing. Since these features were recited as an option in paragraph [0049] of the complete specification of the claimed invention, the amendment is within the scope of the complete specification and is liable to be allowed as per Section 59 of the Patents Act.

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19. Even so, it appears that prior art with regard to the inventive features claimed above, i.e. crank offsets and rotation of crankshafts, were not considered by the Assistant Controller probably in view of the amendments being made at the written submissions stage. From my survey of prior art in the field of endeavour, it appears there could be other relevant prior art. In these circumstances, I am not inclined to direct that the application proceed to grant. Instead, the application is remanded for reconsideration on the limited aspect outlined above. In order to preclude the possibility of pre-determination, any officer other than the officer who issued the impugned order shall undertake reconsideration. Since about 12 years have elapsed from the date of application, it is directed that Indian Patent Application No.8612/CHENP/2012 be disposed of within a maximum period of three months from the date of receipt of a copy of this order by a speaking order. (T) CMA(PT) No.17 of 2023 is disposed of on the above terms without any order as to costs.

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30.04.2024

Index : Yes/No
Internet : Yes/No
Neutral Citation : Yes/No
kal

To

Assistant Controller of Patents & Designs,
Patent Office,
Intellectual Property Building,
G.S.T.Road, Guindy,
Chennai-600 032.

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SENTHILKUMAR RAMAMOORTHY J.

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Pre-delivery judgment made

in

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