

VEHICLE FRAME AND METHOD OF MANUFACTURING A VEHICLE

FIELD OF THE INVENTION

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This invention relates to a vehicle frame and a method of assembly of a vehicle comprising a frame, which is particularly applicable to motorcycle manufacture.

BACKGROUND OF THE INVENTION

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A motorcycle frame is a load bearing structure normally fabricated as a single piece (except for the front fork assembly which is normally a separate sub-assembly of the motorcycle) using components such as steel tube sections, channel sections and gussets welded together in a predetermined configuration. Parts of the motorcycle such as the
15 seat, side cover, trailing arm, stand, footrest, fuel tank and shock absorbers, grab handles and steering assemblies are mounted or fixed on the frame at predetermined locations.

Besides providing basic strength and stiffness to the motorcycle and holding the vehicle
20 parts and bearing the weight thereof, the frame also takes loads resulting from engine vibrations, gear change forces, wheel excitation (due to bumps and corners on the roads) and handling loads such as putting the vehicle on or off a stand. Such a single piece frame is a long, heavy and bulky structure.

25 Further, due to the high amount of welding involved in fabrication of the frame, and due to the single piece frame being long, welding distortions occur leading to inaccuracies in the dimensions and tolerances of the frame. In order to correct the errors, the frame may require corrective operations like straightening thereby leading to additional operations and increasing the manufacturing time.

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In addition, due to the frame being so long, heavy and bulky, transportation of the frame from one place to another, for instance, from manufacturing location to vehicle

assembly location is difficult and has to be done in small batches and carefully to avoid damage and distortions, the frame typically being painted at the manufacturing site. Therefore, such transportation is difficult and time consuming. Despite the careful transportation, which is normally used, there are still chances of the frame being
5 damaged / distorted during transportation thereby causing improper orientation of the various parts assembled on the frame. This calls for additional corrective action vehicle assembly and increases vehicle assembly time. Due to the frame being a long single piece, the vehicle assembly line needs to be long and spacious thereby increasing the space requirement and material handling capacity of the vehicle assembly line.
10 Long distance shipment of the frame requires a large space to accommodate the frame and large packing volume. Therefore, shipment of the frame is more expensive than would otherwise be the case as the number of frames per container is reduced. Furthermore, different types of surface treatments at different frame locations cannot be carried out in an easy and cost effective manner.

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OBJECTS OF THE INVENTION

An object of the invention is to provide a frame assembly of a vehicle, particularly a motorcycle, which may be easily assembled at a vehicle assembly location.

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Another or alternative object of the invention is to provide a frame assembly for a motorcycle which facilitates assembly of different parts on the frame portions or members at different locations so as to minimize assembly operations at the vehicle assembly stage thereby reducing the vehicle assembly line space, material handling
25 capacity and time required for vehicle assembly.

Another or alternative object of the invention is to reduce prevalence of distortion of a vehicle frame during fabrication and improve accuracy of dimensions and tolerances of the frame.

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Another or alternative object of the invention is to reduce or avoid correcting operations such as straightening of the vehicle frame so as to reduce manufacturing time.

- 5 Another or alternative object of the invention is to provide a frame assembly of a motorcycle which can be transported from one place to another, for instance from manufacturing location to vehicle assembly location in a disassembled state and easily assembled together at the vehicle assembly location thereby making it possible to transport the frame assemblies in large quantities easily and conveniently, reducing risk
10 of damage and distortions to the frame.

- Another or alternative object of the invention is to provide a frame assembly of a motorcycle which can be shipped in a disassembled state and more easily assembled at the vehicle assembly location thereby reducing space and packing requirements for
15 shipping and shipping cost as more frame assemblies than single piece frames may be shipped per unit container volume.

- Another or alternative object of the invention is to provide a frame assembly for a motorcycle which facilitates different surface treatments on the frame assembly at
20 different locations in a straightforward cost-effective manner.

- Another or alternative object of the invention is to provide a frame assembly for a motorcycle which facilitates alternative use of rear frame portion to be suitable to carry pillion seat or act as a load carrying member or can be adapted to mount an utility tray.
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DETAILED DESCRIPTION OF THE INVENTION

- With such objects in view, the present invention provides a vehicle frame comprising a plurality of interconnectable frame portions, wherein one frame portion is assembled in
30 a first location with vehicle components to form an intermediate frame component which is assembled to the remainder of said frame portions at a second location different from the first location.

Such a frame may be used in a method of vehicle manufacture. An important application of such a method of manufacture is the field of motorcycles but other vehicles comprising frames may be envisaged. Such a method avoids disadvantages of the above-noted kind and, in particular, allows assembly plants to be reduced in size while reducing the risk of frame distortion encountered using current assembly methods.

The motorcycle frame may comprise a front frame portion and a rear frame portion connected to the front frame portion wherein the front frame portion bears the load of a rider of the motorcycle. The frame may be split into portions at a point allowing the front frame portion to bear the load of the rider. Such a composite frame forms a further aspect of the present invention.

A still further aspect of the invention provides a method of motorcycle production line management comprising the steps of:

- a) providing motorcycle frame portions, at least one frame portion being assembled with motorcycle components to form a sub-assembly at a first optimal location for fabrication of the sub assembly; and
- b) assembling the sub-assembly and remaining frame portions to fabricate a motorcycle frame at a second optimal location for manufacture of the motorcycle wherein the optimal locations are selected to minimize the number of treatment steps required to address frame distortion during production. The first and second optimal locations may, advantageously, be different from each other.

According to one embodiment of the invention, there is provided a frame assembly for a motorcycle comprising at least two frame portions, namely a front portion and a rear portion, the front portion and rear portion being fabricated in a known manner in predetermined configuration, the front portion being adapted to accept a steering and front suspension sub-assembly, and the front and rear portions being provided with interconnection means to interlock and secure the rear portion to the front portion.

Preferably, the interconnection means does not rely on welding the frame portions together.

Preferably, the interconnection means is of a mechanical nature, such as bolting,
5 pinning or riveting. Rigid interconnection means may be used.

By using mechanical or gluing methods to interconnect the frame portions, as opposed to the more typical welding or brazing (or other methods requiring heat), distortion and/or damage to surface finishes can be avoided.

10 Preferably, the front portion and rear portion of the frame have a finished surface prior to interconnection to each other.

Preferably, at least the front frame portion includes fitment means at predetermined locations to mount the parts of the motorcycle such as seat, side cover, trailing arm,
15 stand, footrest, fuel tank, shock absorbers, grab, and steering to the frame.

Preferably, the interconnection means comprises a pair of spaced forearms provided at the front end of the rear portion, the arms having open slots at the tip thereof adapted to be engaged over laterally extending studs provided at the rear end of the front portion, a
20 pair of spaced bushes provided at the front end of the rear portion and a pair of oppositely disposed U-shaped brackets provided at the rear end of the front portion, the bushes being located in the U-shaped brackets and bolted rigidly to fit together the front portion and rear portion.

25 Conveniently, the laterally extending studs provided at the rear end of the front portion also act as upper attachment points for a pair of rear shock absorbers.

By splitting the motorcycle into at least two frame portions, production line flexibility may be increased as different versions of the rear frame portion can be selected from a
30 suite of available rear frame portions and used on the same front frame portion. For instance, one design of rear frame portion may be suitable for carrying a load such as a pillion passenger or a utility tray. In that case, the rear frame portion would carry a seat,

whilst an alternative design may be suitable to act as a load carrier or may be adapted to fit a goods carrying utility tray. Conversely, this invention allows selection of a front frame portion from a suite of different versions of the front frame portion for assembly onto a rear frame portion. Thus versatility may be increased at the assembly production
5 line by using common front portions with different rear portions or vice versa for different versions of the final motorcycle.

Conveniently, the rear frame portion is received at the final motorcycle assembly line, with other parts already assembled to it, such as a rear mudguard, or grab handle. In
10 this state, the rear frame portion forms part of an intermediate frame component, which is connected to the remaining frame portions at the final assembly site. Using this manufacturing process allows increased flexibility to the motorcycle manufacturer as the opportunity arises for a third party supplier to manufacture, surface finish, and pre-assembly the rear frame portion with one or more parts, and present this sub-assembly
15 to the motorcycle manufacturer for final vehicle assembly.

The above embodiments of the invention allow manufacturing distortions to be minimised and allow more economy of space at the assembly plant. Packing requirements are also reduced since the division of the frame into portions allows
20 packaging of smaller components. Transportation of a large bulky single piece frame is avoided.

The invention may be more fully understood from the following description of preferred embodiments of the invention made with reference to the accompanying
25 drawings, in which:

Figures 1, 2 and 3 are side view, plan and isometric views, respectively of a frame assembly for a motorcycle according to an embodiment of the invention;

30 Figures 4, 5 and 6 are side view, plan and isometric views, respectively, of the front frame portion of the frame assembly of Figures 1, 2 and 3;

Figures 7, 8 and 9 are side view, plan and isometric views, respectively of the rear frame portion of the frame assembly of Figures 1, 2 and 3;

Figure 10 is a side view of a motorcycle comprising the frame assembly of Figures 1, 2
5 and 3 having different parts of the motorcycle assembled thereon;

Figures 11, 12 and 13 are side view, plan and isometric views, respectively, of the front frame portion of a frame assembly according to another embodiment of the invention;
Figures 14, 15 and 16 are side view, plan and isometric views, respectively of the front
10 frame portion of a frame assembly according to another embodiment of the invention;

Figure 17 illustrates the sub assembly of rear frame comprising of different components mounted on it.

15 Figure 18 illustrates an outline of a rider on the vehicle with frame assembly with two portions according to the invention.

The frame assembly or split frame 1 as illustrated in Figures 1 to 9 of the accompanying drawings comprises two frame portions, namely a front frame portion 2
20 and a rear frame portion 3. Both the front frame portion 2 and rear frame portion 3 are fabricated independently in a known manner, for instance, using components – such as steel tube sections (square, rectangular, circular, oval etc), channel section and gussets by welding them together in a predetermined configuration. The front and rear frame portions 2 and 3 are provided with fitments at predetermined locations to mount or fix
25 parts of the motorcycle in a known manner. For instance, head pipe 4 mounts the steering 4a and handle bar shaft (not shown) of the motorcycle shown in Figure 10 of the drawings.

Such fitments also include the following. Brackets for mounting the engine 5j of the
30 motorcycle (Figure 10) are marked 5,5. Bolt holes for mounting the engine are marked 5a, 5b, 5c, 5d, 5e, 5f, 5g and 5h (Figure 1 & 4). Mounting bracket 6 is for mounting the fuel tank 27 and seat 28 of the motorcycle (Figure 10). Brackets for mounting the

shock absorbers (not shown) of the motorcycle are marked 7, 7 (Figure 5) and the studs therein are marked 7a and 7b.

Holes 8a and 8b are mounting holes to mount air filter 8 of the motorcycle. 9a and 9b are bushes for mounting the air filter. Mounting bracket 10 mounts the seat lock (not shown) of the motorcycle and its associated bolt holes are marked 10a and 10b (Figure 9). Brackets 12a and 12b are the mounting brackets for the grab handle 12c of the motorcycle.

Bracket 14 is a mounting bracket for a guard, which prevents clothing on the legs of the pillion rider getting entangled with the rear wheel of the motorcycle. 16a, 16b, 16c and 16d are mounting location of footrest assembly 16 (Figure 10) of the rider of the motorcycle, which is directly supported at the bottom of the engine. 17a, 17b and 20 are mounting locations of the bracket 20a for the footrest assembly of the pillion rider (not shown) of the motorcycle. 18 is mounting location for the brake pedal 18a on bracket 5 of the motorcycle. The mounting location for the trailing arm 29 of the motorcycle is 20. Bolt holes mounting the rear fender are marked 22a, 22b, 22c and 22d (Figure 9). Mounting location for the stand 13a of the motorcycle is marked 13. Locations for mounting the side covers of the motorcycle are marked 25a, 25b and 27a, 27b.

The front end of the rear frame portion 3 is provided with a pair of forearms 19a and 19b having open slots 19c and 19d at the tips thereof adapted to be engaged over laterally extending studs 7a and 7b provided at the rear end of the front portion. The forearms 19a and 19b are clamped onto the studs 7a and 7b by nuts (not shown) after inserting the top eyelets of the shock absorber (not shown) of the motorcycle over the studs. 21a and 21b are a pair of spaced bushes provided on spaced arms 15a and 15b respectively at the front end of the rear frame portion 3 and 11a and 11b are pair of oppositely disposed U-shaped brackets provided at the rear end of the front portion. The brackets 11a and 11b are each provided with holes 31a, 31b in the flanges thereof. The bushes 21a and 21b are located in the brackets and bolted to the brackets by running bolts 23a, 23b through the bushes 21a and 21b and the holes in the flanges of the brackets and tightening the bushes in the U-shaped brackets nuts 24a and 24b with

the rear frame portion 3 and front frame portion 2 positioned in tandem so as to rigidly fit the front and rear frame portions 2 and 3 together. The front and rear frame portions 2 and 3 are thus easily rigidly assembled together by nuts and bolts as rigid interconnection means. The frame portions 2 and 3 may be easily dismantled by
5 removing the nuts and bolts. The front and rear frame portions 2 and 3 can be assembled together with other fastening arrangements/processes such as welding or riveting, although welding is less preferable due to distortion effects due to heating as well as surface damage which may occur. Figure 18 depicts the outline of a rider on the
10 motorcycle with this invention. It may be observed that the frame assembly is split at a point below and towards the rear of the seating point of the rider. The rider is sitting on the front portion of the frame assembly; hence the front portion of the frame assembly bears the load of the rider, which is an aspect of the invention.

The front frame portion 2 of the split frame as illustrated in Figures 11 to 13 of the
15 accompanying drawings is similar to that of Figures 1 to 6 except that the former includes a cradle 32 welded to sections 33 and 34 of the front frame portion 2. The footrest assembly 16 is mounted on the cradle 32 at locations marked 16a, 16b, 16c and 16d. 13 is a mounting location for the stand. The rear frame portion 3 illustrated in
20 Figures 7 to 9 is connected to the front frame portion 2 as described earlier.

The front frame portion 2 of the split frame is illustrated in Figures 14 and 16 of the accompanying drawings is similar to that of Figures 1 to 6 except that the former includes a cradle 35 welded to the head pipe 4 and sections 36a, 36b and 37. The engine is mounted on the cradle at location 5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h, and 5i. The
25 footrest is mounted on the cradle at locations 16a, 16b, 16c and 16d. 13a, 13b are mounting locations for the stand. The rear portion of the frame as illustrated in Figures 7 to 9 is attached to the front portion as described earlier.

Figure 17 illustrates the rear frame subassembly comprising of rear frame portion 3,
30 rear fender 40, tail lamp 41, blinkers 42 and vehicle number plate 43. The tail lamp 41, blinkers 42 and vehicle number plate 43 are mounted on rear fender 40. Rear fender 40 is in turn mounted on rear frame 3 at locations marked as 22a, 22c and 22b, 22d. This

sub assembly can be directly taken to vehicle assembly line and connected to front frame assembly.

5 The motorcycle frame portions 2 and 3 of a motorcycle, as illustrated in the drawings, can be easily assembled at the vehicle assembly location. The frame portions 2 and 3 are individually considerably smaller in size as compared to the whole frame. Therefore, during fabrication of the two frame portions, distortions are practically eliminated and if distortions still occur, such will be minimal or negligible. Therefore, accuracy of dimensions and tolerances of the frame is maintained, thereby avoiding
10 corrective operations like straightening of the frame. The overall manufacturing time is thus reduced.

The frame 1 can be transported in disassembled state from one place to another, for instance, from manufacturing location to vehicle assembly location. Therefore, it is
15 possible to transport the frames easily and conveniently and without causing damage/distortions. Assembly/mounting of parts on front and rear portions of the frame can be done at a location other than the vehicle assembly line and only few parts need to be assembled on the vehicle assembly line. This increases production line flexibility and reduces the space and material handling capacity required for the vehicle
20 assembly. The time for vehicle assembly is also reduced. Frame 1 can be shipped long distances in disassembled state with reduced packing. The space and packing requirements for shipping and shipping cost are, therefore, reduced. It is also possible to give different types of surface treatment to the frame at different locations easily and in a cost effective manner.

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Modifications and variations of the vehicle frame and methods of manufacture of the present invention may be apparent to the skilled reader of this disclosure. Such modifications and variations are deemed within the scope of the present invention.

CLAIMS

1. A vehicle frame for a motorcycle comprising a plurality of interconnectable frame portions, wherein one frame portion is assembled in a first location with vehicle components to form an intermediate frame component for assembly to the remainder of said frame portions at a second location different from the first location.
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2. A vehicle frame as claimed in claim 1, wherein the frame is split into front and rear portions corresponding with front and rear of a motorcycle, the split being at a point allowing the front frame portion to bear the load of a rider.
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3. A vehicle frame as claimed in claim 1 or 2, wherein the frame portions are subjected to surface finish prior to interconnection to each other.
4. A vehicle frame as claimed in any one of claims 1 to 3, wherein the interconnection between the frame portions is made by mechanical or rigid interconnection means.
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5. A vehicle frame as claimed in any one of claims 1 to 4, wherein at least one frame portion includes fitment means at predetermined locations to mount the parts of the vehicle to the said vehicle frame.
6. A method of manufacturing a vehicle comprising a frame as claimed in any one of claims 1 to 5, including the assembly of different parts on the said vehicle frame portions at different locations.
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7. A method as claimed in claim 6 wherein the frame has front and rear frame portions corresponding with front and rear of a vehicle wherein a rear frame portion is selected from a suite of available rear frame portions to allow production line flexibility.
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8. A method as claimed in claim 6 wherein the frame has front and rear frame portions corresponding with front and rear of a vehicle wherein a front frame portion is selected from a suite of available front frame portions to allow production line flexibility.
- 5 9. A vehicle comprising a vehicle frame as claimed in any one of claims 1 to 8.
10. A vehicle frame for a motorcycle comprising a plurality of interconnectable frame portions wherein the frame is split into front and rear portions corresponding with front and rear of a vehicle, the split being at a point allowing the front frame portion to bear the load of a rider.
- 10 11. A vehicle frame as claimed in any one of the claims 1 to 5 or 10 wherein the rear frame portion is a load carrying member.
12. A vehicle frame as claimed in claim 11 wherein the rear frame portion is adapted to carry a pillion passenger or utility tray.
13. A motorcycle comprising the vehicle frame of claim 9.
- 15 14. A method of motorcycle production line management comprising the steps of:
 - a) providing motorcycle frame portions, at least one frame portion being assembled with motorcycle components to form a sub-assembly at a first optimal location for fabrication of the sub assembly; and
 - 20 b) assembling the sub-assembly and remaining frame portions to fabricate a motorcycle frame at a second optimal location for manufacture of the motorcycle wherein the optimal locations are selected to minimize the number of treatment steps required to address frame distortion during production
- 25 15. A vehicle frame substantially as hereinbefore described with reference to the drawings.