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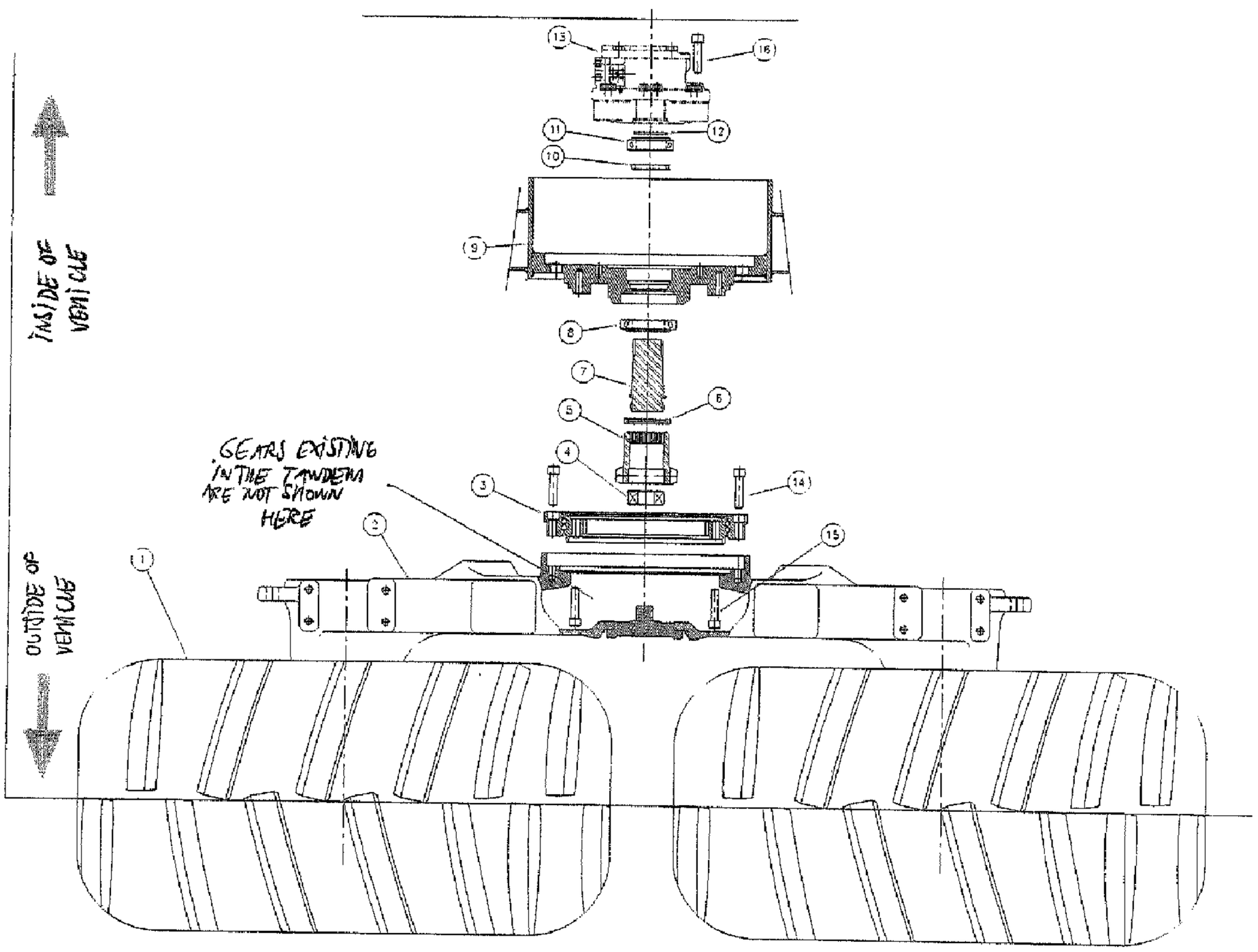
(54) Title: TANDEM WHEEL ASSEMBLY, MOBILE SILVICULTURAL APPARATUS INCLUDING THE SAME, AND METHOD FOR OPERATING THE APPARATUS



TANDEM WHEEL ASSEMBLY, MOBILE SILVICULTURAL APPARATUS INCLUDING THE SAME, AND METHOD FOR OPERATING THE APPARATUS

Field of the invention:

The present invention relates to an improved tandem wheel assembly. More particularly, the present invention relates to a mobile silvicultural apparatus, provided with such an improved tandem wheel assembly, generally a pair of such tandem wheel assemblies, for operating in a land of trees and the like, in order to carry out various harvesting applications. The present invention also relates to the method for operating the mobile silvicultural apparatus. The mobile silvicultural apparatus may be, for example, a land clearing tractor for selectively clearing a land of brush, trees and the like.

Background of the invention:

Known in the art are various mobile silvicultural apparatuses and the tandem wheel assemblies and corresponding transmission mechanisms used therewith. Indeed, Figures 1 and 2 show a typical example of a conventional tandem wheel assembly and corresponding transmission mechanism.

Such a conventional tandem wheel assembly is commercialized by a German company called NAF. This type of component is used widely on silvicultural apparatuses. The tandem comprises a segment including gears at the entrance, which is typically located at the center of the tandem. The gears are generally mounted in a profiled recess which is sealed in an air-tight manner so as to enable the gears to continuously soak in lubrication means, such as an oil bath, for example. The gears, placed in series, enable to transmit the power coming from the transmission for the propulsion of the vehicle up to the wheels of said vehicle. In order to maximize the comfort of a user in the vehicle during the displacement thereof on a land to be treated, such as a forest, for example, the tandem is mounted on the frame of the vehicle by means of a large ball bearing enabling the tandem to rotate about its center.

The transmittal of power coming from the transmission and being redirected towards the wheels is carried out normally in a manner as shown in Figures 1 and 2. A driving shaft with universal joints originates from the exit of the transmission in order to get to the entrance of the central gear box. A gear pair transmits the power in the shafts directed towards the gears of the tandem. It is known that the distance between the supports of the power transmission shaft is large. Indeed, the more a silvicultural apparatus is wide, the more this distance becomes substantial.

An important aspect to be considered with tandem wheel assemblies is that the large central bearing linking the latter to the frame of the vehicle is not perfectly rigid. Thus, under the efforts which are applied to the central bearing during the operation of the vehicle, a misalignment of the internal gears of the tandem and of the power transmission shaft may arise. In such case, given the fact that there is a great distance between the supports of the power transmission shaft, even if there is a misalignment, the resulting angle will be negligible on the components. Thus, the additional efforts applied to the components will not cause any failure thereof.

However, a substantial problem associated with the above-mentioned type of tandem wheel assembly is that it is not intended to efficiently receive and cooperate with hydraulic motors for driving the mobile silvicultural apparatus. This is particularly true when the ground-clearing portion of the front unit of the apparatus is substantially high with respect to the ground on which the apparatus travels.

Hence, in light of the aforementioned, there is a need for an improved tandem wheel assembly which, by virtue of its design and components, would be able to overcome some of the aforementioned prior art problems.

Summary of the invention:

The object of the present invention is to provide a tandem wheel assembly which satisfies some of the above-mentioned needs and which is thus

an improvement over other related tandem wheel assemblies known in the prior art.

In accordance with the present invention, the above object is achieved, as will be easily understood, with a tandem wheel assembly such as the one briefly described herein and such as the one exemplified in the accompanying drawings.

According to another aspect of the invention, there is also provided a silvicultural apparatus provided with the above-mentioned tandem wheel assembly. Preferably, the silvicultural apparatus is provided with at least one pair of such tandem wheel assemblies

According to yet another aspect of the invention, there is also provided a kit for assembling the above-mentioned tandem wheel assembly.

According to yet another aspect of the invention, there is also provided a method for operating the above-mentioned silvicultural apparatus.

The objects, advantages and other features of the present invention will become more apparent upon reading of the following non-restrictive description of preferred embodiments thereof, given for the purpose of exemplification only with reference to the accompanying drawings.

Brief description of the drawings:

Figure 1 is a top sectional view of a tandem wheel assembly and corresponding transmission mechanism according to the prior art.

Figure 2 is a top sectional view of a portion of the transmission mechanism shown in Figure 1.

Figure 3 is a side elevation view of a mobile silvicultural apparatus according to the present invention.

Figure 4 is a top plan view of what is shown in Figure 3.

Figures 5-8 are different views of the components of the silvicultural apparatus of Figure 3.

Figure 9 is a top sectional view of a tandem wheel assembly according to a first preferred embodiment of the present invention.

Figure 10 is an exploded view of what is shown in Figure 9.

Figure 11 is a top sectional view of a tandem wheel assembly according to a second preferred embodiment of the present invention.

Figure 12 is an exploded view of what is shown in Figure 11.

Figure 13 is an enlarged view of what is shown in Figure 9.

Figure 14 is an enlarged view of what is shown in Figure 10.

Figure 15 is an enlarged view of what is shown in Figure 11.

Figure 16 is an enlarged view of what is shown in Figure 12.

Figure 17 illustrates different views of a coupling system of a tandem wheel assembly according to the present invention.

Figure 18 illustrates different views of a front unit of the mobile silvicultural apparatus of Figure 2.

Detailed description of preferred embodiments of the invention:

In the following description, the same numerical references refer to similar elements. The embodiments shown in Figures 3-18 are preferred.

Broadly described, the present invention, as illustrated in the accompanying drawings, relates to an improved tandem wheel assembly, and to a mobile silvicultural apparatus provided with such an assembly, as well as to the method for operating the mobile silvicultural apparatus.

List of numerical references and corresponding components illustrated:

1 Tire of the vehicle

2 Tandem

3 Securing bearing of the tandem

4 Self-aligning bearing

5 Driving shaft

6 Tapered roller bearing

7 Frame of the vehicle

8 Sealing joint

9 Tapered roller bearing

10 Retaining ring

11 Hydraulic motor

12 Securing bolt of the bearing on tandem

13 Securing bolt of the bearing of the tandem on frame of vehicle

14 Securing bolt of the hydraulic motor

The mobile silvicultural apparatus, as better shown in Figures 3 and 4, is preferably intended to carry out various types of harvesting applications, such as land clearing, for example, with a method utilizing preferably a system of parallel bands. Such a silvicultural apparatus and method are better described in US patent No. 6,550,505, which is incorporated herein by reference. The mobile silvicultural apparatus according to the present invention comprises a steerable wheel support frame comprising a horizontally extending ground-clearing section,

and first and second opposite vertical side sections, the ground clearing and side sections defining a tunnel-shaped passage through which trees and other items of a certain type are allowed to pass as the support frame travels thereover. The apparatus also comprises manipulating means, such as an articulated boom, shredder heads, and the like, mounted to the support frame for selectively manipulating trees and the like. The apparatus also comprises motor means for imparting motion to the support frame, and control means for controlling the steerable support frame, the motor means, and the manipulating means.

In order to obtain a substantially thin physical space for the driving system of the vehicle in the front unit thereof for example, several developments have been made to the wheel assemblies, as explained briefly hereinbelow.

Indeed, since the ground clearing section of the apparatus is fairly elevated with respect to the ground on which the apparatus travels, the motor means, which preferably consist of hydraulic motors, for imparting motion to the support frame of the apparatus, are preferably placed at the entrance of the tandems for driving the gears and the tandems, as better shown in Figures 5-17. Indeed, there is shown in these drawings how, due to a misalignment allowed by the large bearing, the assembly according to the first preferred embodiment, as better shown in Figures 9, 10, 13 and 14, has a fairly small life span.

Therefore, a new assembly has been developed where the power transmission shaft comprises preferably at least two portions in order to have a flexible zone, as better shown in Figures 16 and 17. Crowned splines, as better shown in Figure 17, are used for being able to achieve a large misalignment. The final assembly is thus better shown in Figures 11, 12, 15, 16 and 17. As shown in these figures, the crowned splines offer a suitable flexibility within a restrained space, as apparent to a person skilled in the art. Thus, as can be easily understood, a significant improvement of the present tandem wheel assembly resides in the use of the above-mentioned crowned splines, with this type of shortened assembly, as better shown in the accompanying drawings.

As may now be better appreciated, the present invention is a substantial improvement over the prior art in that the present tandem wheel assembly enables to, among other advantages, use hydraulic motors within a constrained space, thanks to the use of the above-mentioned crowned splines, which are better illustrated in Figure 17.

It is worth mentioning that although the present invention was primarily intended for silvicultural applications, the present tandem wheel assembly, the apparatus provided with such an assembly, and the method for operating the apparatus, may be used in other fields and for other applications, such as for mining applications, agricultural applications, and the like, as apparent to a person skilled in the art, without departing from the scope of the present invention.

Of course, numerous modifications could be made to the above-described embodiments without departing from the scope of the invention, as apparent to a person skilled in the art.

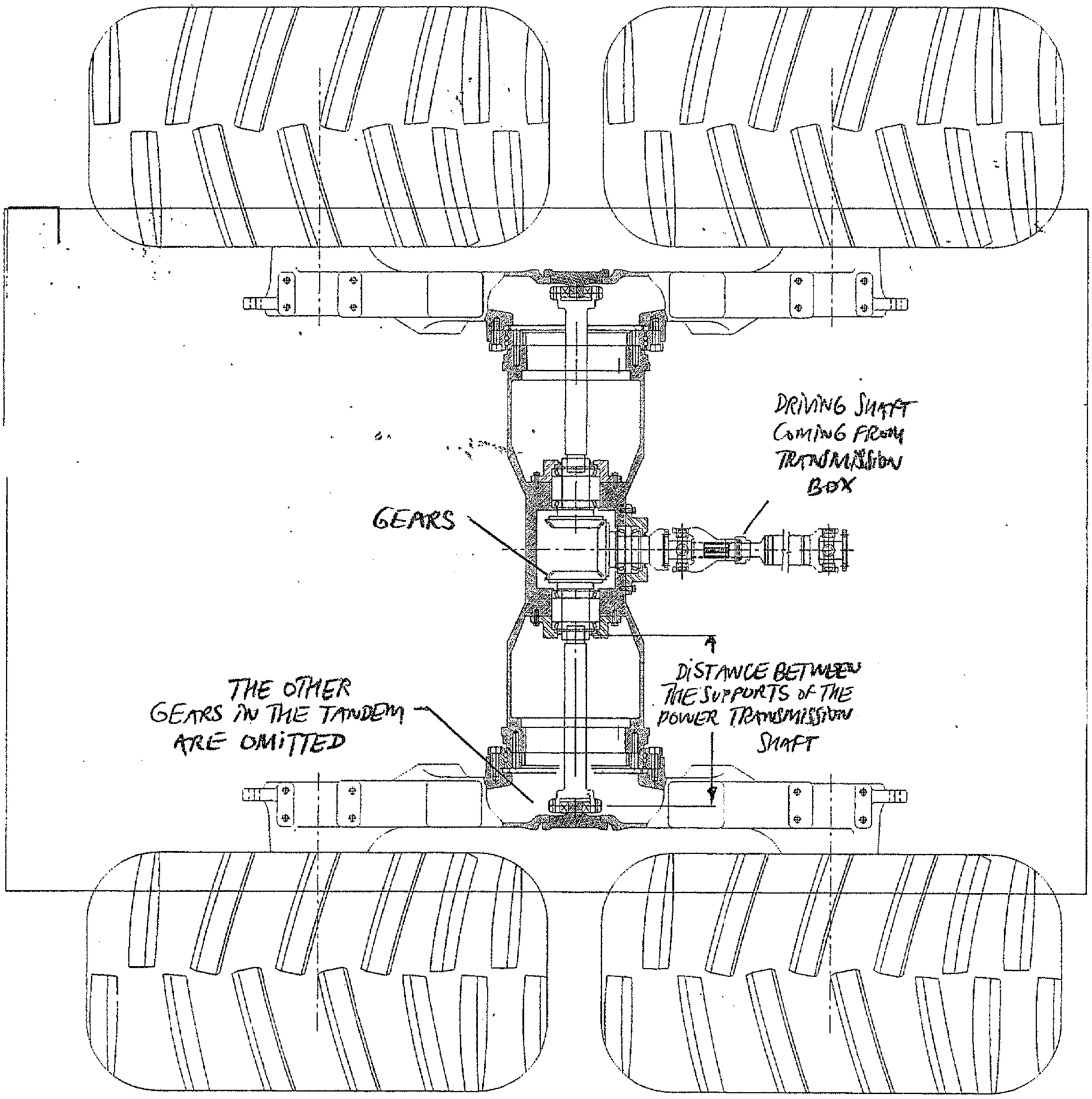


FIG. 1 (PRIOR ART)

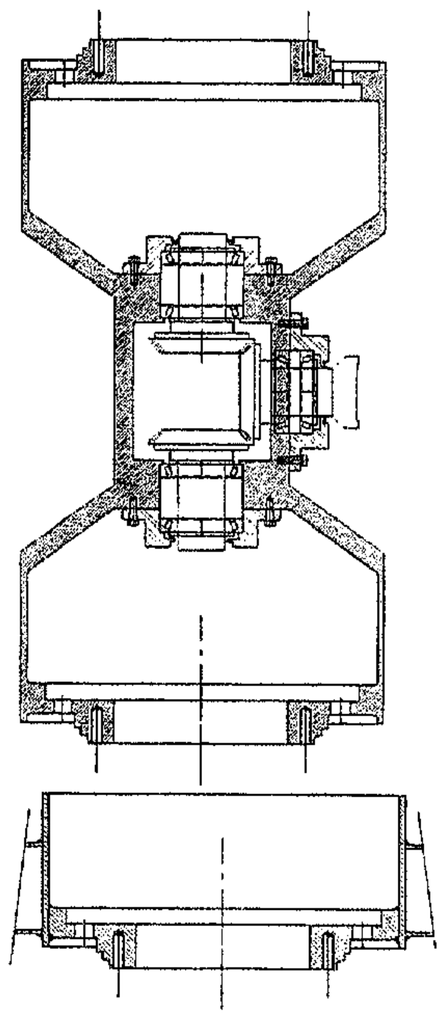


FIG. 2

(PRIOR ART)

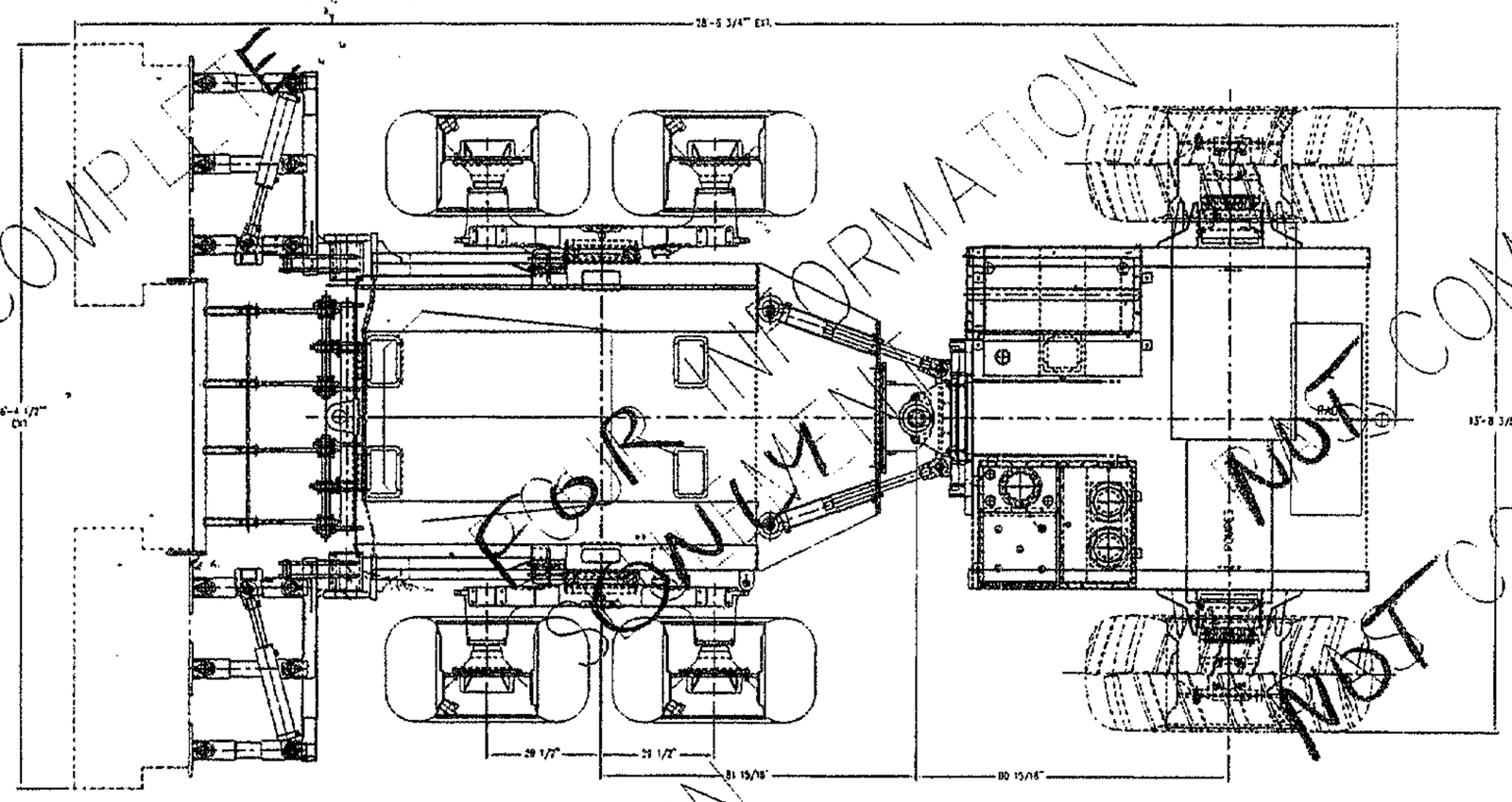


Fig.4

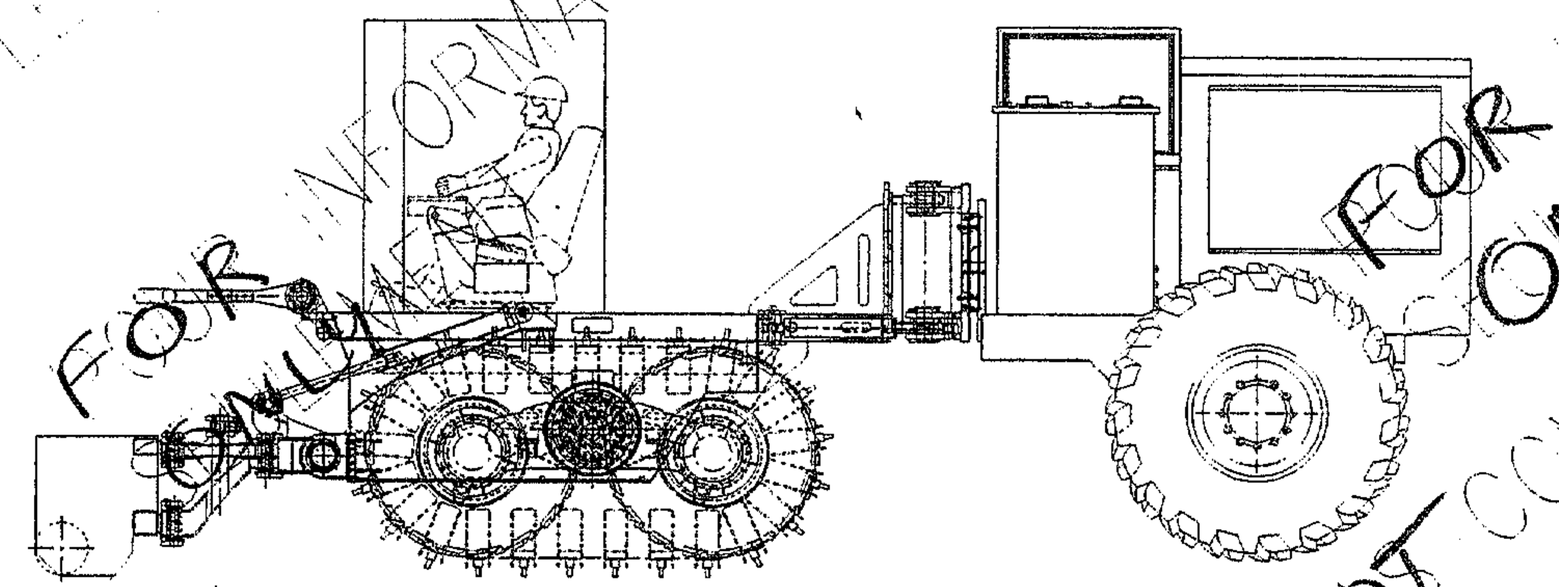


Fig.3

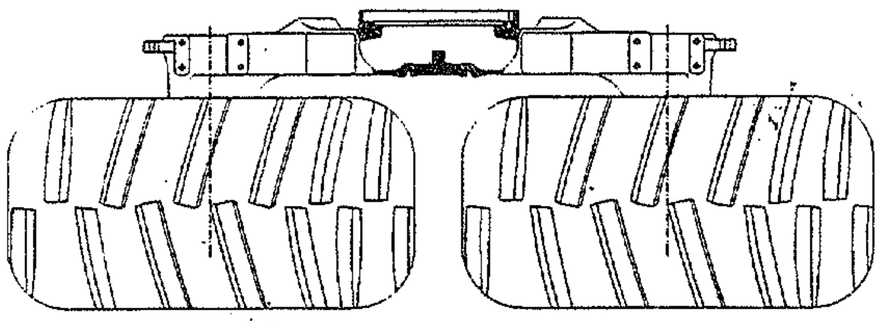


FIG.5

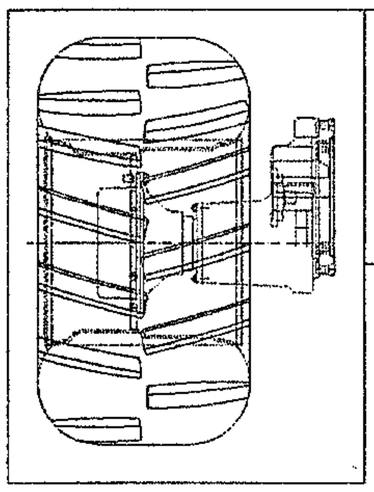


FIG.6

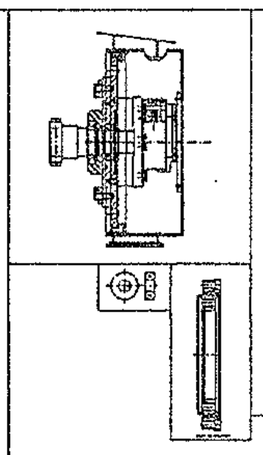


FIG.7

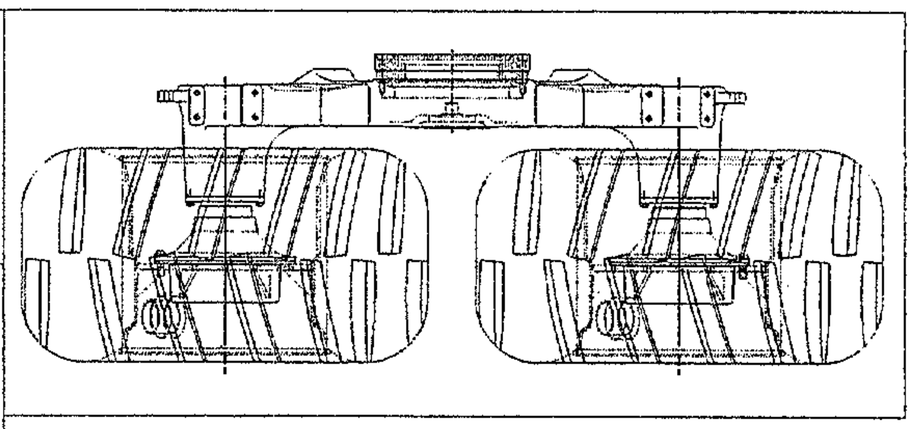
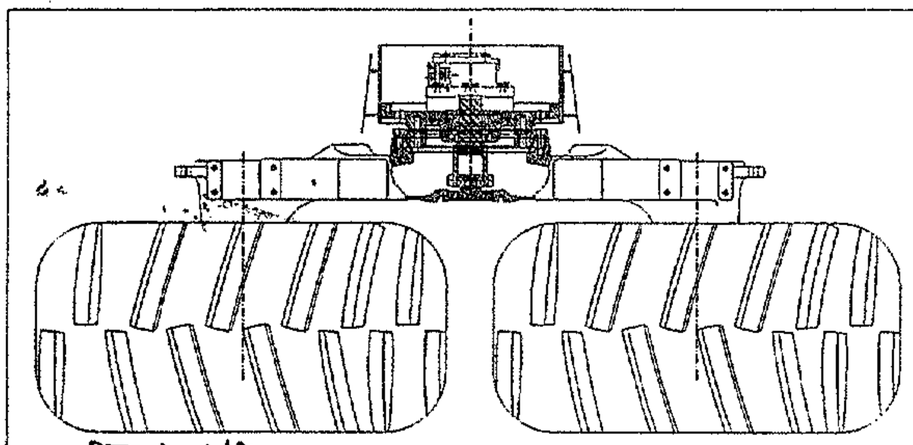
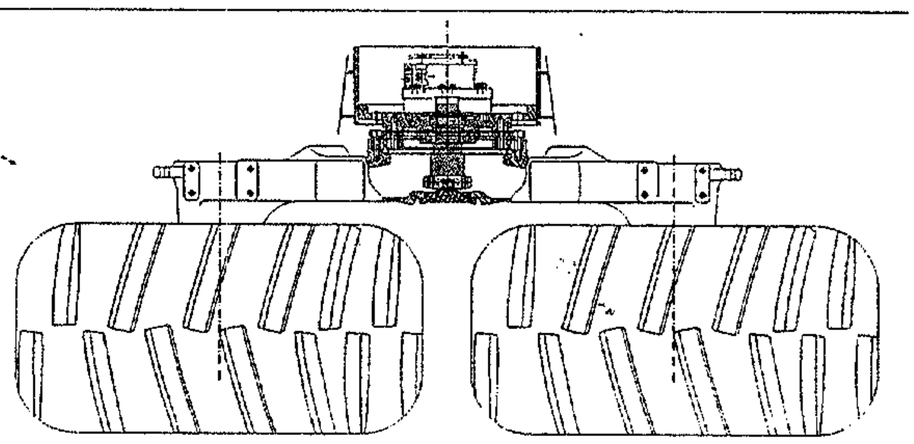


FIG.8



SECTIONAL #2 SHAFT IN 2 SECTIONS FIG.9



SECTIONAL #1 ~~ARBRE~~ ORIGINAL SHAFT FIG.11

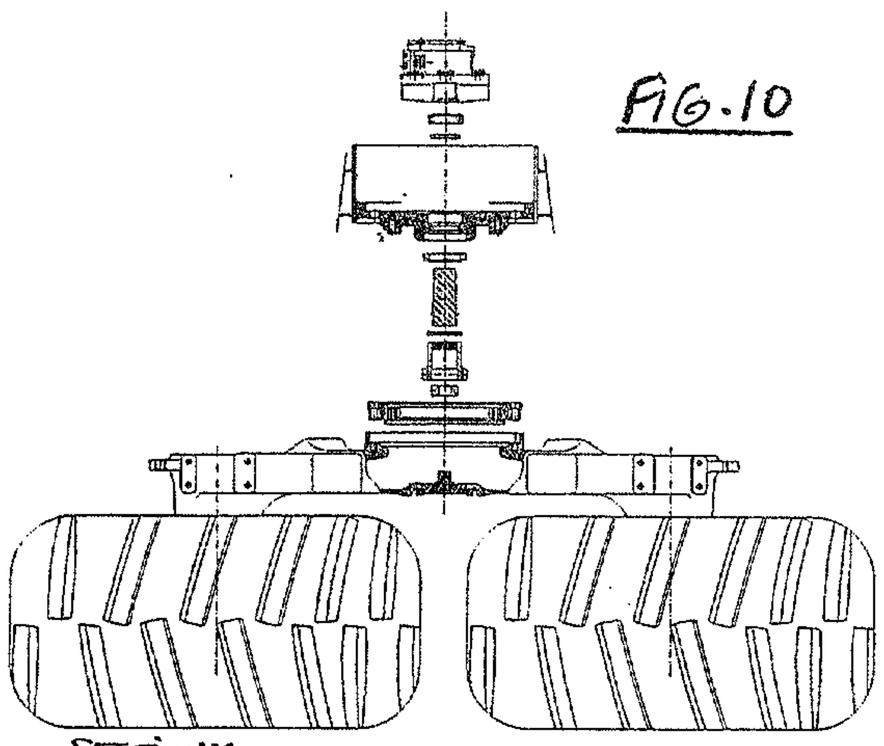


FIG.10

SECTIONAL #2 SHAFT IN 2 SECTIONS

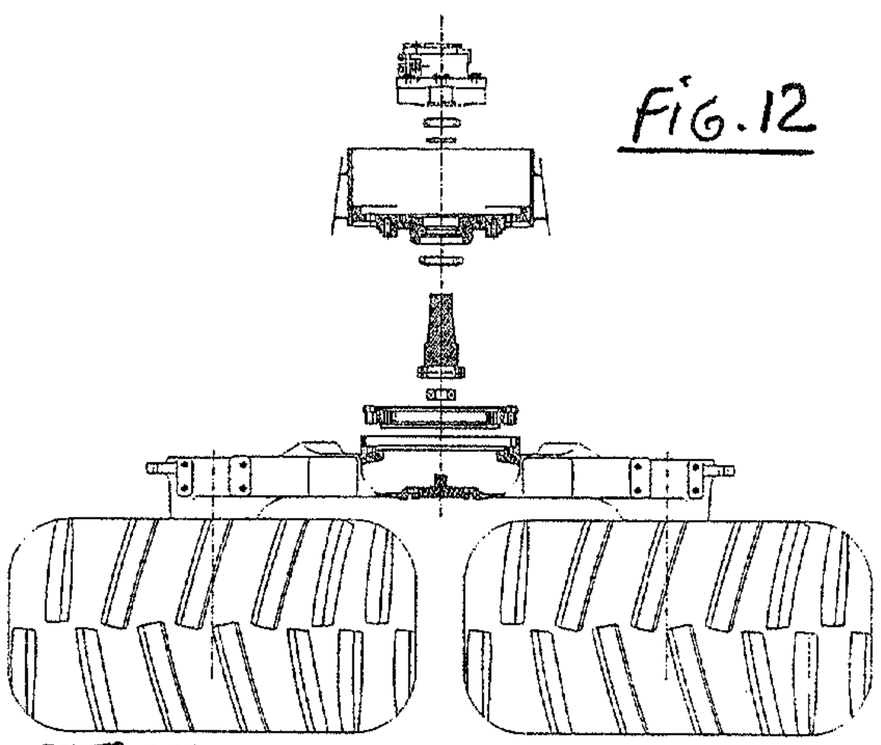


FIG.12

SECTIONAL #1 ~~ARBRE~~ ORIGINAL SHAFT

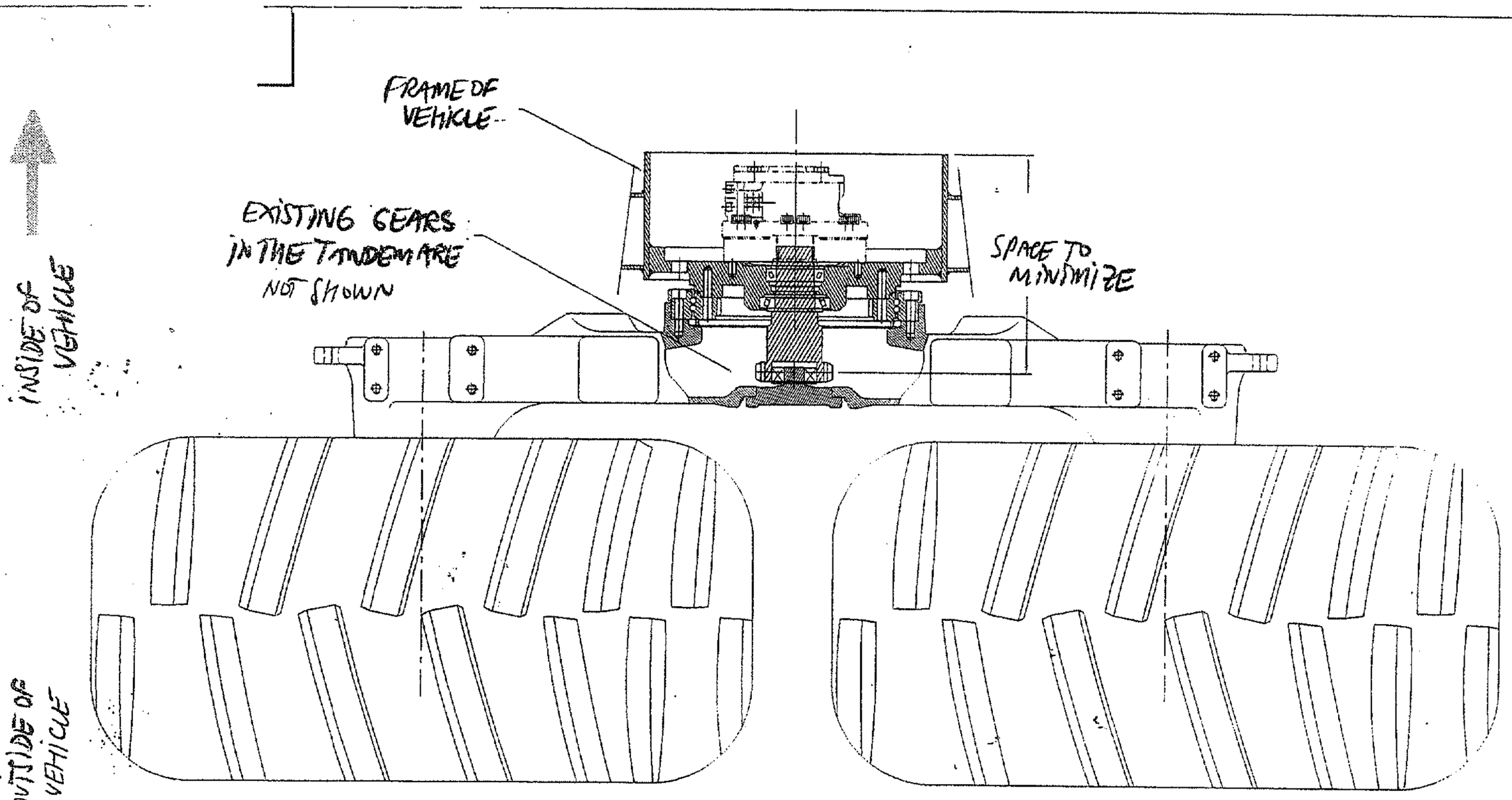
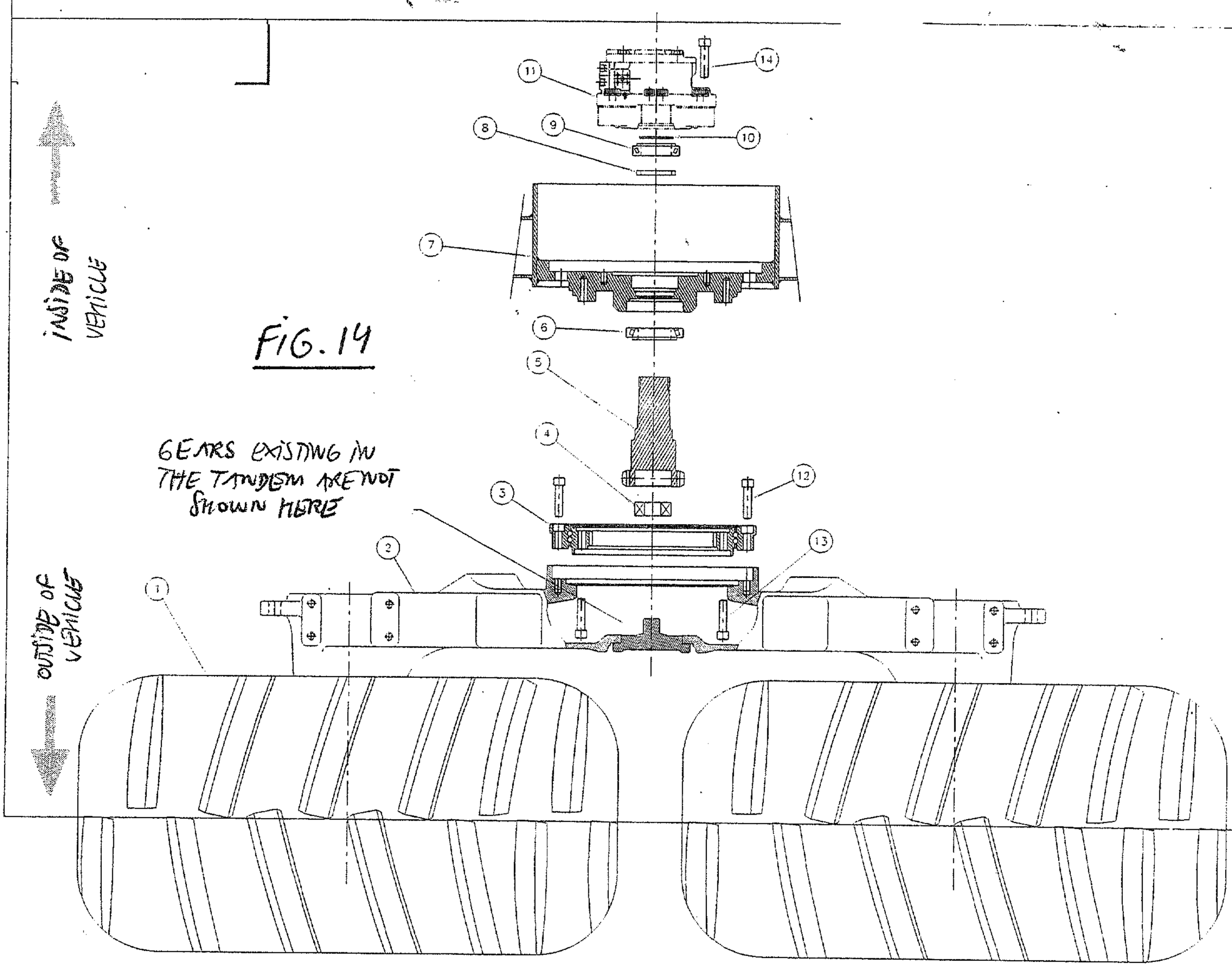

FRAME OF VEHICLE
EXISTING GEARS IN THE TANDEM ARE NOT SHOWN
SPACE TO MINIMIZE
INSIDE OF VEHICLE
OUTSIDE OF VEHICLE

FIG. 13


INSIDE OF VEHICLE
OUTSIDE OF VEHICLE
GEARS EXISTING IN THE TANDEM ARE NOT SHOWN HERE
1
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14

FIG. 14

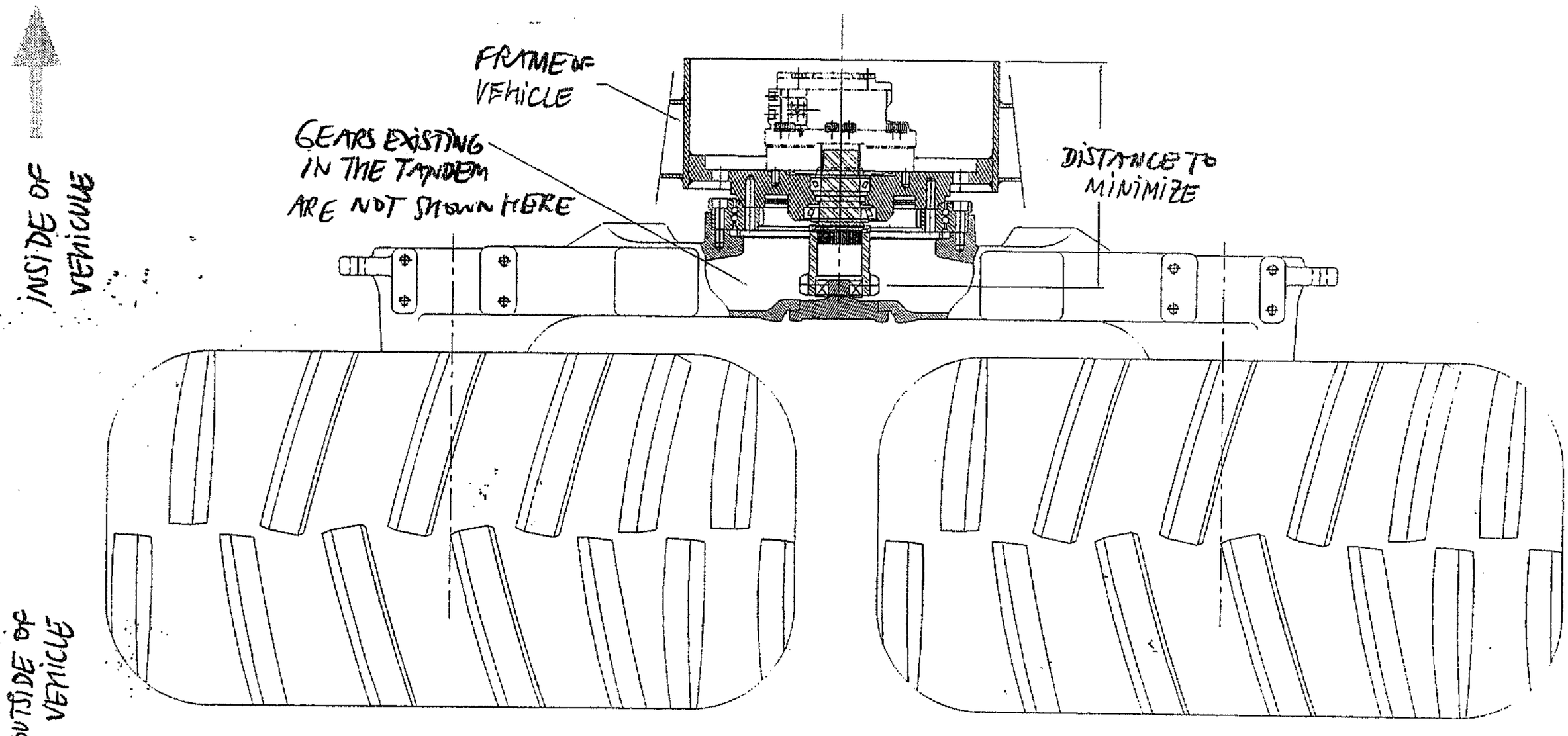

INSIDE OF VEHICLE
FRAME OF VEHICLE
GEARS EXISTING IN THE TANDEM ARE NOT SHOWN HERE
DISTANCE TO MINIMIZE
OUTSIDE OF VEHICLE

FIG. 15

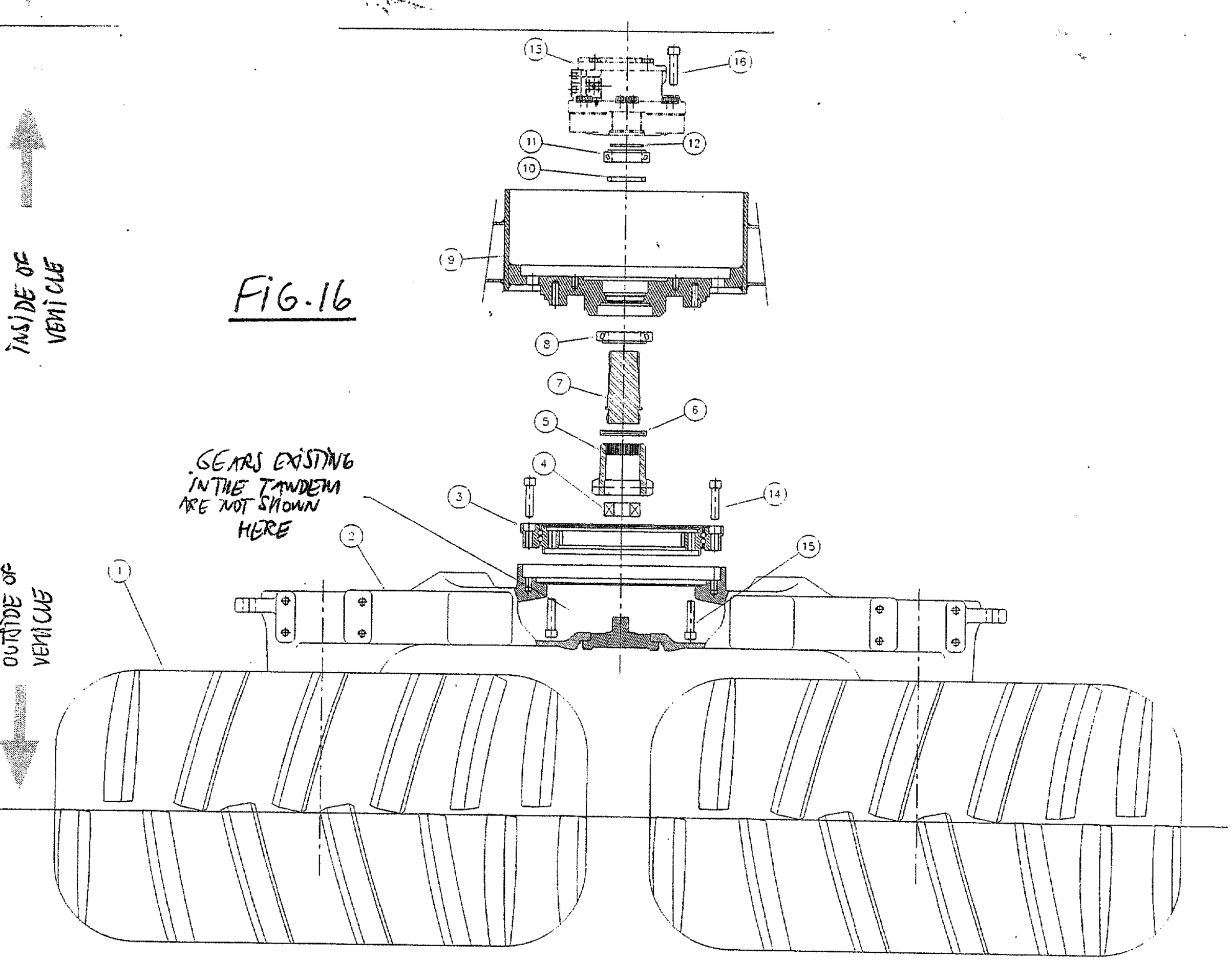
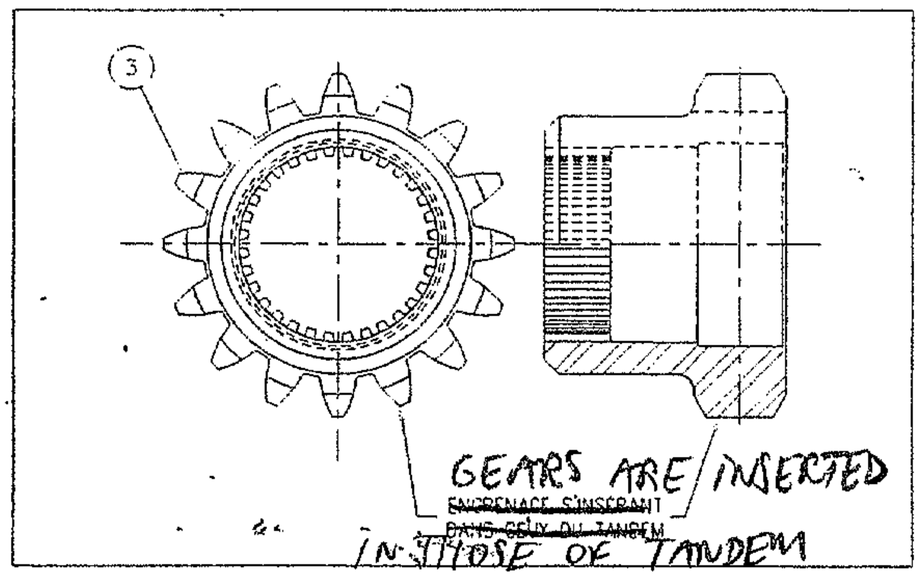
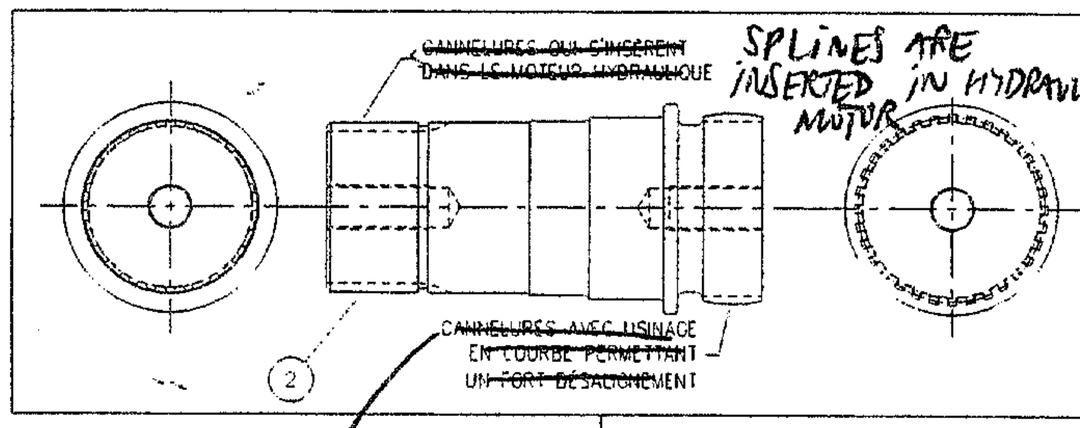

INSIDE OF VEHICLE
13
16
11
12
10
9
8
7
6
5
4
3
14
2
15
1
GEARS EXISTING IN THE TANDEM ARE NOT SHOWN HERE
OUTSIDE OF VEHICLE

FIG. 16



ITEM	QTÉ	DESCRIPTION	LONGUEUR	MASSE	LIBRE	PERMISSIBLE
1		~~ARBRE PARTIE FIXE~~				
2		~~ESPACEUR~~				
3		~~ARBRE PARTIE FLEXIBLE~~				



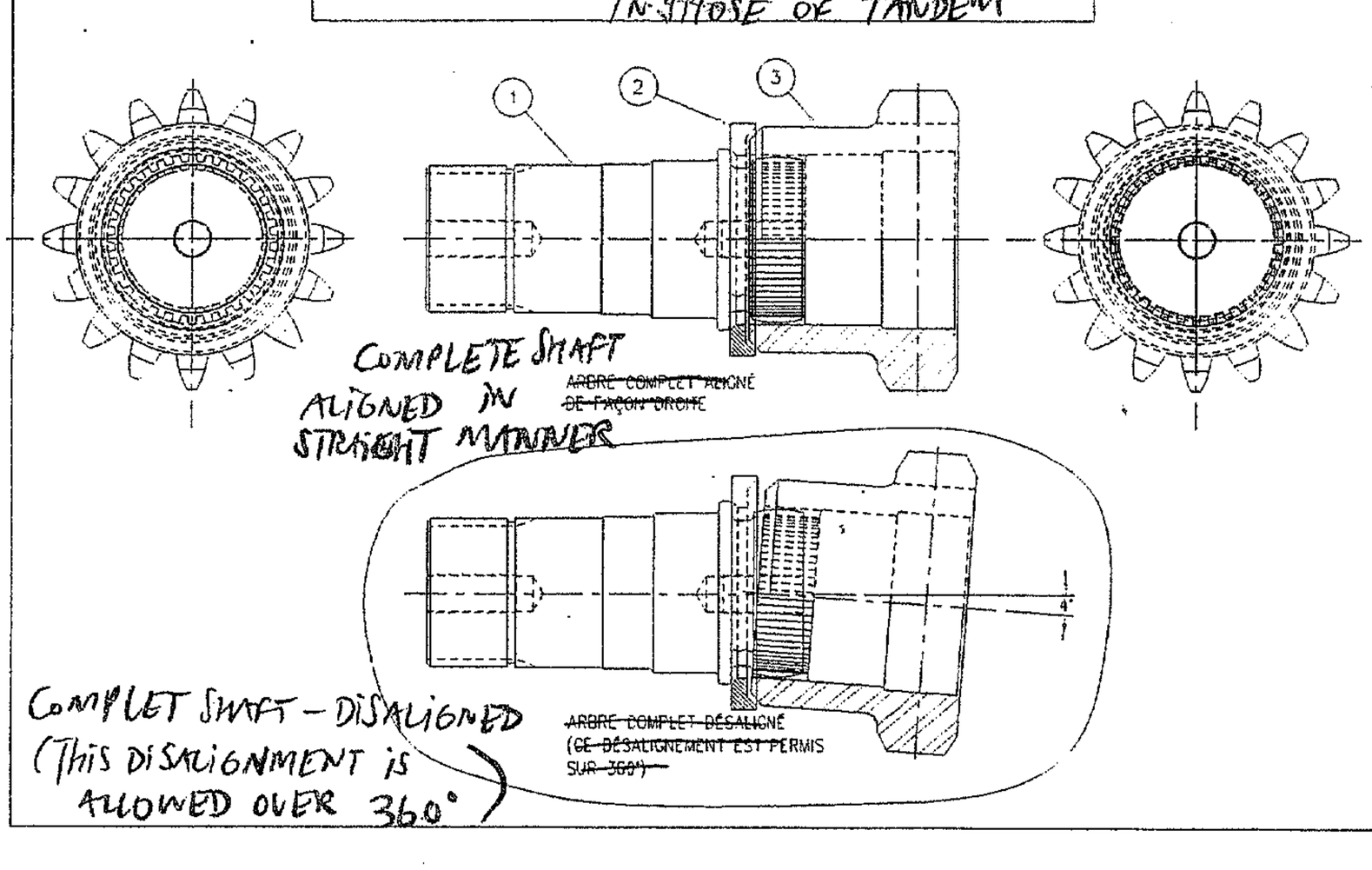
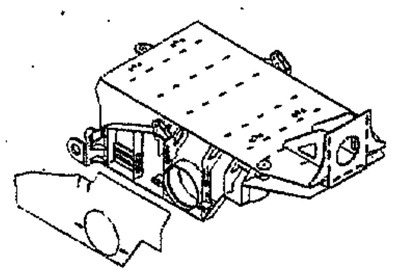


FIG. 17

① SHAFT – FIXED PORTION
② SPACER
③ SHAFT – FLEXIBLE PORTION



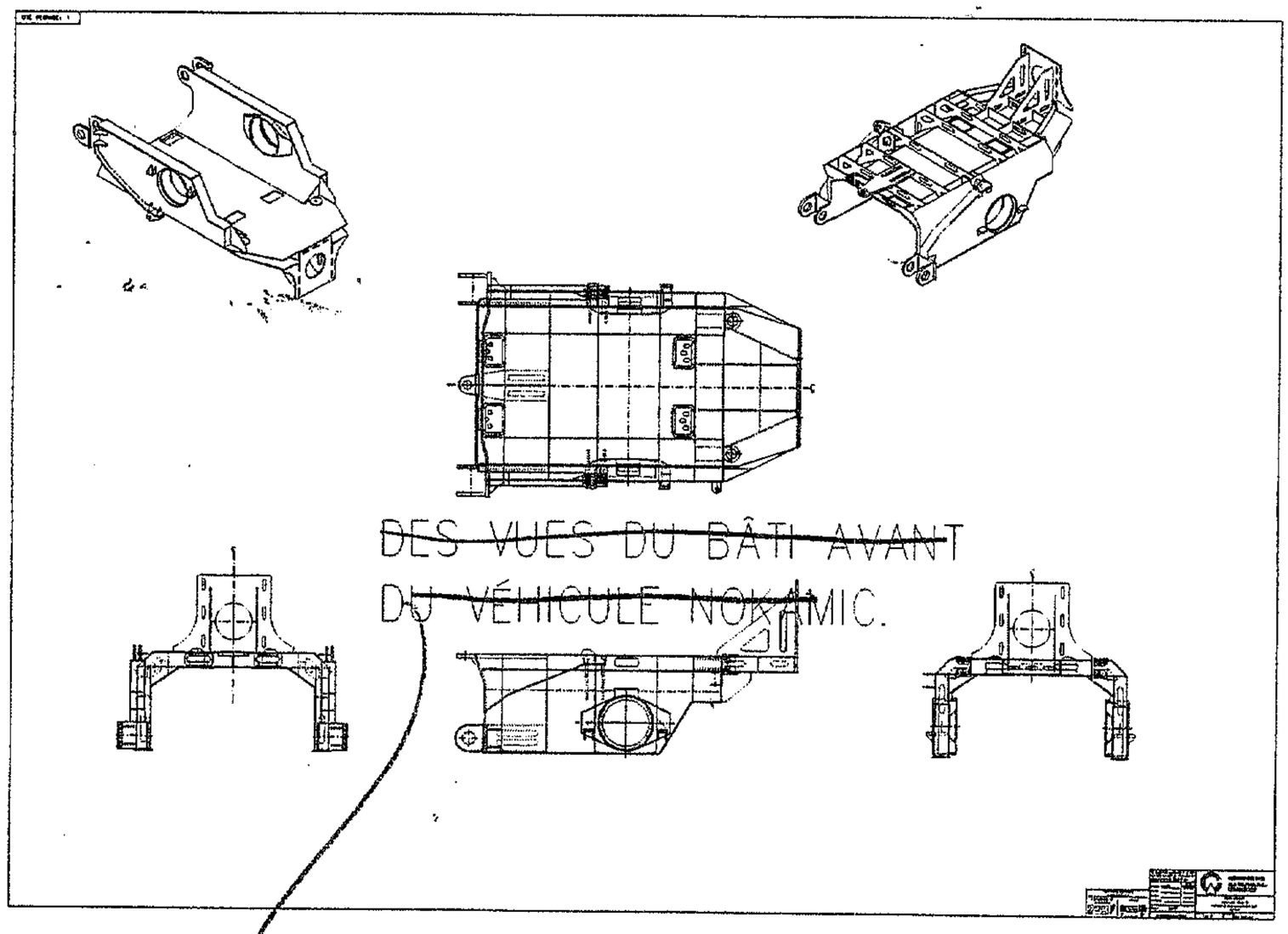
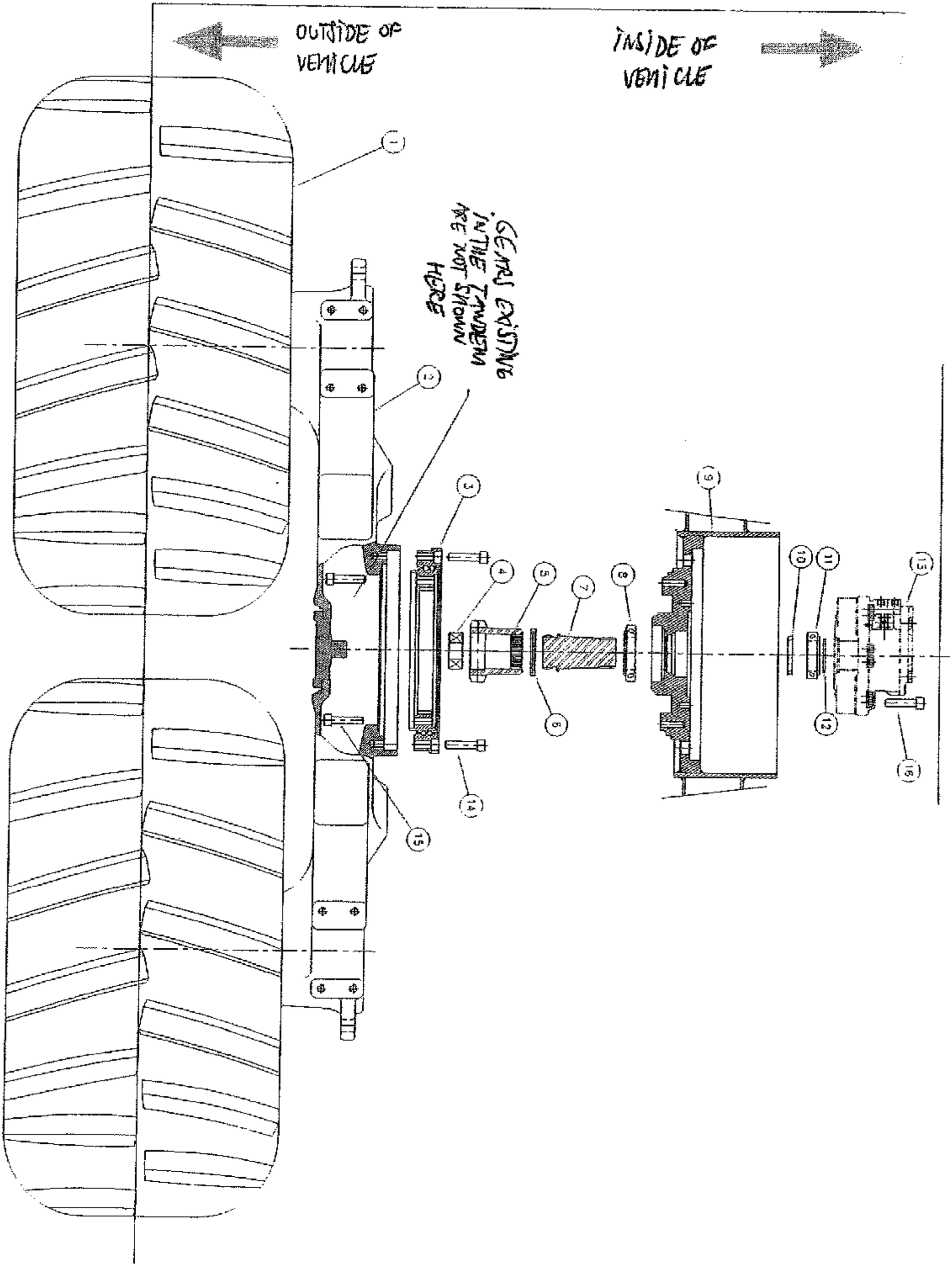


FIG. 18

VIEWS OF FRONT PORTION OF NOKAMIC VEHICLE


OUTSIDE OF VEHICLE
INSIDE OF VEHICLE
1
2
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