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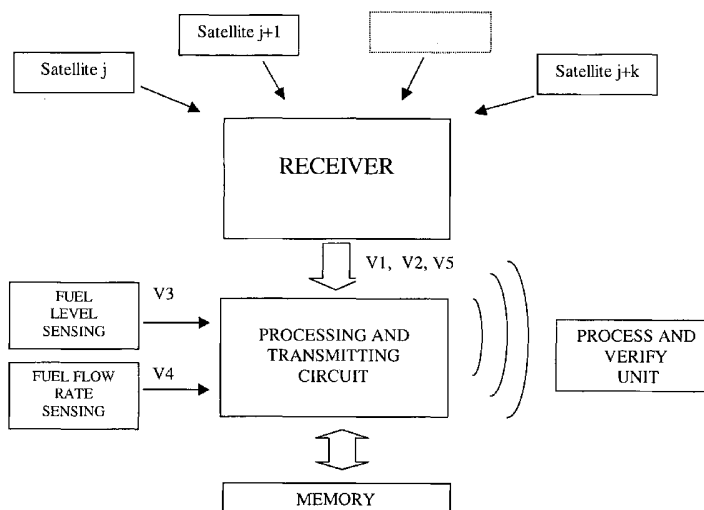
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(54) Title: SYSTEM FOR VERIFYING THE CONSUMPTION OF APPARATUSES USING ENDOTHERMIC MOTORS



(57) Abstract: System for verifying consumption of apparatuses using endothermic motors includes a receiver (1), mounted on a relative apparatus for supplying a first electric signal (V1) and a second electric signal (V2), indicating respectively, the apparatus spatial coordinates and the time of measurement of the coordinates. A device (2), mounted on said apparatus, processes a third electric signal (V3) and a fourth electric signal (V4), indicating respectively, the level of fuel present in the apparatus tank and the flow rate of fuel leaving the tank, and the first electric signal (V1) and second electric signal (V2) define a biunique correspondence between the triad of value, defined by the first electric signal (V1), third electric signal (V3), fourth electric signal, and the time of measurement (V2), common to the first, third, fourth electric signals (V1, V3, V4). Advantageously, the receiver (1) supplies a fifth electric signal (V5) indicating the apparatus speed.

**SYSTEM FOR VERIFYING THE CONSUMPTION OF APPARATUSES USING
ENDOTHERMIC MOTORS**

FIELD OF THE INVENTION

5 The present invention relates to the technical field concerning systems for receiving, processing and transmitting data, performed by vehicles in motion, with respect to one or more remote stations.

In particular, the present invention relates to systems
10 for processing and verifying data concerning the consumption of apparatuses using endothermic motors, such as terrestrial and floating vehicles, and aircrafts.

DESCRIPTION OF THE PRIOR ART

15 In the road transport field, there are the so-called "non-technical losses", that is losses, which are not of technical nature, but which derive from illegal human actions: this category includes any fuel theft occurred at the start or during the selected journey, as well as
20 the use of the vehicle for personal purposes or anyway, for purposes which are not connected with the driver's professional activity.

For example, a vehicle standing in a parking area could be subjected to a fuel theft, a driver could make a
25 different, not arranged previously, trip for personal reasons, or a refueling of bigger value than the real one could be reported, by using the usual report documents.

This fact, difficult to verify, causes economic damages, which influence considerably the balance of either small
30 or big fleets of public or private vehicles.

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There are satellite receivers, such as the GPS, which allow automatic tuning over the frequencies of selected orbital artificial satellites, and which can, after processing the data coming from at least four satellites, supply the latitude, longitude, height, and possibly the detecting speed and time connected to these parameters, with the uncertainty level remaining within some meters, according to the adopted technology.

At present, such receivers are largely used and installed on vehicles in order to visualize geographic position thereof and the shortest routes to the destinations.

Figure 1 shows a block diagram of remote-monitoring used for heavy transport vehicles and also for other vehicles: in this example, the GPS receiver processes the data coming from the satellites, supplying, as it has already been specified, the vehicle position, the speed and correlated time of measurement; the pieces of information are stored in a memory and then sent, with periodical time intervals and according to a given transmission protocol, to a processing and control central unit, which manages the anti-theft system.

The mobile phones frequencies are generally used, because they assure best covering of the whole national territory, however it is possible to use the GPRS or satellite systems.

SUMMARY OF THE INVENTION

The object of the present invention is to propose a consumption verifying system for endothermic motors, which is capable of detecting possible "non-technical losses" related to the fuel consumption.

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Another object of the present invention is to propose a consumption verifying system for endothermic motors, which is easy to install and which completes the functions of the known apparatuses.

5 The above mentioned objects are obtained, in accordance with the contents of the claims, by a consumption verifying system for apparatuses using endothermic motors, characterized in that it includes a combination of: a receiver, mounted on a relative apparatus, for
10 supplying a first and a second electric signals, which identify, respectively, the spatial coordinates of the apparatus and the time when the measurement of the coordinates is done; a device, mounted on the apparatus for processing a third and a fourth electric signals,
15 indicating respectively, the level of fuel present in the apparatus tank and the flow rate of the fuel leaving said tank, as well as said first and second electric signals to define a biunique correspondence between the triad of values, defined by said first, third, fourth electric
20 signals, and said measurement time, common to said first, third, fourth electric signals.

BRIEF DESCRIPTION OF THE DRAWINGS

25 The characteristic features of the invention are pointed out in the following description of some preferred but not exclusive embodiments, with reference to the enclosed figures, in which:

- Figure 1 is a block diagram of a known transmission system;
- 30 - Figure 2 is a block diagram of a first embodiment of the proposed system;

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- Figure 3 is a block diagram of a second embodiment of the system proposed by the present invention;
- Figure 4 is a block diagram of a third embodiment of the system proposed by the present invention.

5

DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to Figure 2, a receiver 1, for example of a GPS, a processing and transmitting circuit 2, and a memory 3, mounted on an apparatus using endothermic motors, such as a terrestrial vehicle.

A plurality of artificial satellites, present in a variable number on the apparatus horizon, usually emit signals high frequency signals, which can be received by the receiver 1, and which indicate the spatial position, the speed and time of measurement related to such position and speed.

The receiver 1 carries out the primary function of processing the signals of at least four of the satellites, so as to supply an exact indication of its own latitude, longitude, height, speed and the time related to this measurement.

The processing and transmitting circuit 2 receives the above mentioned electric signals, corresponding to the spatial coordinates (first electric signal V1), to the apparatus speed (fifth electric signal V5), and to the related measurement time (second electric signal V2), together with the electric signal corresponding to the level of fuel present in the tank of the described apparatus (third electric signal V3), and to the flow rate of fuel going out from the tank or entering the endothermic motor (fourth electric signal V4).

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The circuit 2 is a device, which defines a biunique correspondence between the set of four values, defined by the first electric signal V1, fifth electric signal V5, third electric signal V3, fourth electric signal V4, and
5 the measurement time V2 common for the above signals.

Latitude, longitude, height, speed, fuel level and flow rate, and the related measurement time will be grouped in groups of seven values to create data sequences.

The sequences will be stored in a memory 3, present in
10 the apparatus, and sent, according to a suitable transmission protocol, e.g. GSM, GPRS or satellite transmission system, to a processing and control central unit 5, which stores and processes them according to determined calculation algorithms.

15 For example, the derivative value of the signal V3 with respect to time, indicating the fuel level, could be calculated in order to verify if the obtained result, disregarding the scale factors, coincides with the electric signal V4 indicating the fuel flow rate.

20 According to some embodiments, these additional functions could be calculated by the processing and transmission circuit 2, then sent to the processing and control central unit 5.

According to some possible variants, the above mentioned
25 processing functions, peculiar to the device 2, are performed within the receiver 1, leaving to the device 2 only data transmission function.

According to a second embodiment, shown in a block diagram of Figure 3, the central processing and control
30 unit is excluded, thus the sequences of information related to spatial coordinates (signal V1), the apparatus speed (signal V5), fuel level (signal V3), fuel flow

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rate (signal V4), and related measurement time (signal V2) will be stored in the memory 3 present in the apparatus referred to, and then transferred later on, to an external memory, not shown, e.g. with the apparatus standstill, by suitable devices aimed at data transferring, likewise not shown, as they are known.

According to a third embodiment, differently from the previous one, the above mentioned information is visualized on a display 6 (see Figure 4), after being processed by a software, which makes its contents easily comprehensible, e.g. for verifying the route made by the apparatus on a topographic map, for verifying instant or medium fuel consumption, etc.

One of the advantages of the present invention lies in the fact that it proposes a system for consumption control for apparatuses using endothermic motors, which allows detection of possible "non technical losses", connected to the fuel consumption, completing the functions of known apparatuses, such as GPS receiver, and transmission systems, such as GSM, GPRS, satellite, WIFI, Blue Tooth and others.

Another advantage of the present invention lies in the fact that it proposes an extremely versatile consumption verifying system operating in relation to the real way run by the apparatus using endothermic motors.

Further advantages derive from the fact that the proposed system is capable of understanding additional calculation algorithms, performed by the same apparatus, or at the control and processing central unit, which give indication about not only the apparatus speed and direction on a map, e.g. topographical or nautical, but also about specific consumption along the way to follow.

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A still further advantage of the invention lies in the fact that it allows a definition of the way actually covered by the apparatus, after the processing of the data transmitted by the latter, thus allowing a verify of
5 its correspondence to the one accorded by the driver and the employer.

Another advantage of the invention derives from the fact that it proposes a system, which, besides fulfilling the above described functions, is also a reliable antitheft
10 system, supplying not only the spatial coordinates of the apparatus, but also its consumption to the central control unit, at regular intervals.

A yet further advantage of the present invention lies in the fact that the information processed by the
15 consumption verifying system can be used by the apparatus user by printing it on a display.

Another advantage of the invention derives from the fact that it proposes a consumption verifying system, whose technical-functional aspects can be advantageously
20 reproduced in general apparatuses, such as terrestrial and floating vehicles, and aircrafts.

The present description takes into consideration the fourth electric signal V4, indicating the flow rate of fuel leaving the tank, however, the proposed system
25 maintains unchanged its advantageous technical-functional aspects also without this signal.

In other words, the technical solution proposed by the present invention, can be applied also to the apparatuses, which do not have a device for measuring the
30 fuel flow rate, because the electric signal V3 indicating the fuel level in the tank gives a reliable indication about the apparatus actual consumptions.

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It is understood that the proposed invention has been described as a mere, non limiting example, therefore, it is obvious that any practical-application variants applied thereto remain within the protective scope
5 defined by the following claims.

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CLAIMS

1. System for verifying the consumption in apparatuses using endothermic motors, characterized in that it
5 includes a combination of:

a receiver (1), mounted on a related apparatus for supplying a first electric signal (V1) and a second electric signal (V2), indicating respectively, the apparatus spatial coordinates and the time when said
10 coordinates are measured;

a device (2), mounted on said apparatus for processing a third electric signal (V3) and a fourth electric signal (V4), indicating respectively, the level of fuel present in the apparatus tank and the flow rate of fuel leaving
15 said tank, and said first electric signal (V1) and second electric signal (V2) to define a biunique correspondence between the triad of values, defined by said first electric signal (V1), third electric signal (V3), fourth electric signal, and said time of measurement (V2),
20 common to said first, third, fourth electric signals (V1, V3, V4).

2. System, as claimed in claim 1, characterized in that it includes a data collecting memory (3), which contains
25 sequences of values, each of which defined by said triad of values, said first electric signal (V1), third electric signal (V3), fourth electric signal (V4), and by said time of measurement (V2), in order to allow the transmission, at regular intervals, of packets including
30 a prefixed quantity of said sequences toward a processing and control central unit (5).

- 10 -

3. System, as claimed in claim 1, characterized in that it includes a data collecting memory (3), which contains sequences of values, each of which defined by said triad
5 of values, said first electric signal (V1), third electric signal (V3), fourth electric signal (V4), and by said time of measurement (V2), in order to allow the acquisition of said sequences by an external memory, with the apparatus standstill.

10

4. System for verifying the consumption of apparatuses using endothermic motors, characterized in that it includes a combination of:

a receiver (1), mounted on a related apparatus for
15 supplying a first electric signal (V1) and a second electric signal (V2), indicating respectively, the apparatus spatial coordinates and the time when said coordinates are measured;

a device (2), mounted on said apparatus for processing a
20 third electric signal (V3) indicating the level of fuel present in the apparatus tank, and said first electric signal (V1) and second electric signal (V2) to define a biunique correspondence between the couple of values, defined by said first electric signal (V1) and third
25 electric signal (V3), and said time of measurement (V2), common to said first electric signal (V1) and third electric signal (V3).

5. System, as claimed in claim 4, characterized in that
30 it includes a data collecting memory (3), which contains sequences of values, each of which defined by said couple

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of values, said first electric signal (V1) and third electric signal (V3), and by said time of measurement (V2), in order to allow the transmission, at regular intervals, of packets including a prefixed quantity of said sequences toward a processing and control central unit (5).

6. System, as claimed in claim 4, characterized in that it includes a data collecting memory (3), which contains sequences of values, each of which defined by said couple of values, said first electric signal (V1) and third electric signal (V3), and by said time of measurement (V2), in order to allow the acquisition of said sequences by an external memory, with the apparatus standstill.

15

7. System for verifying consumption of apparatuses using endothermic motors, characterized in that it includes a combination of:

a receiver (1), mounted on a relative apparatus for supplying a first electric signal (V1) and a second electric signal (V2), indicating respectively, the apparatus spatial coordinates and the time when said coordinates are measured;

a device (2), mounted on said apparatus for processing a fourth electric signal (V4) indicating the flow rate of fuel leaving the apparatus tank, and said first electric signal (V1) and second electric signal (V2) to define a biunique correspondence between the couple of values, defined by said first electric signal (V1) and fourth electric signal (V4), and said time of measurement (V2), common to said first electric signal (V1) and fourth electric signal (V4).

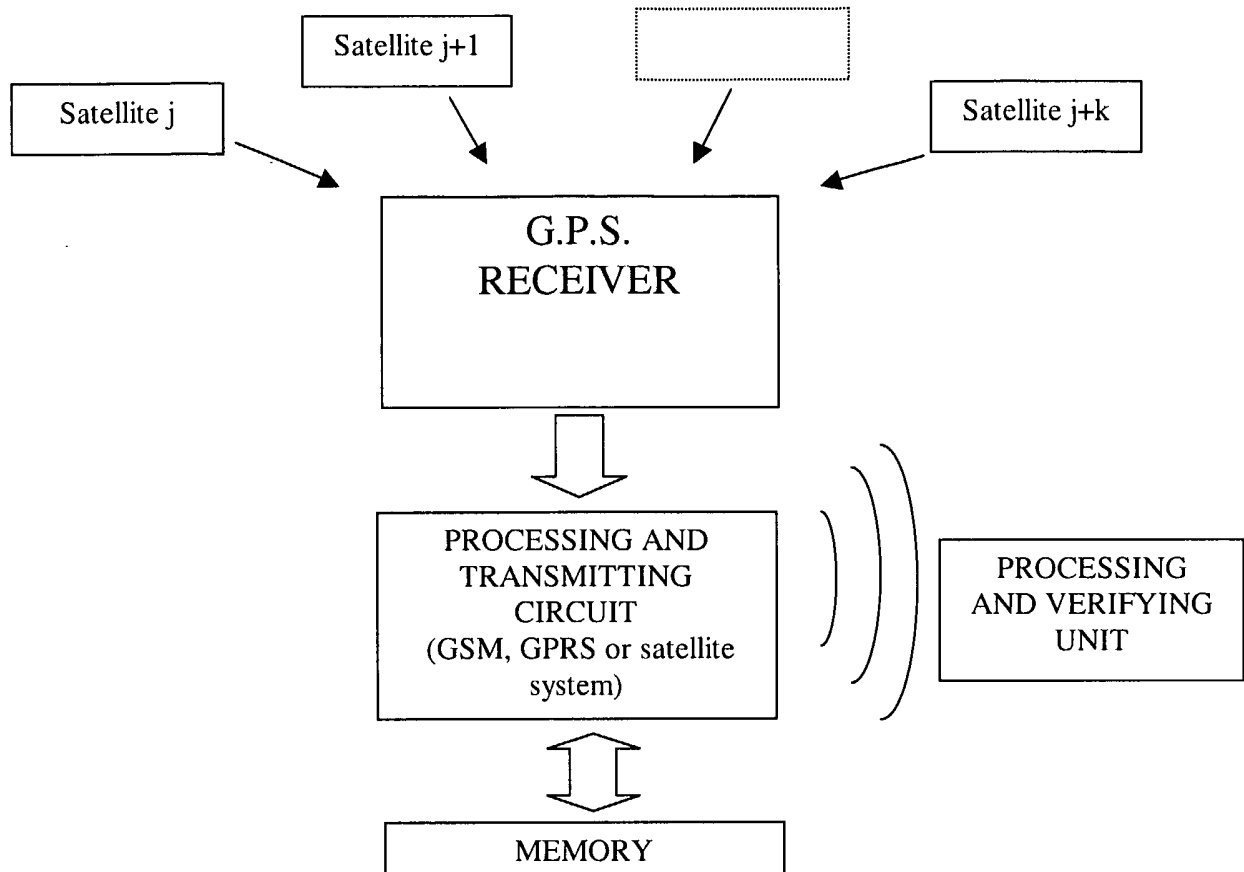
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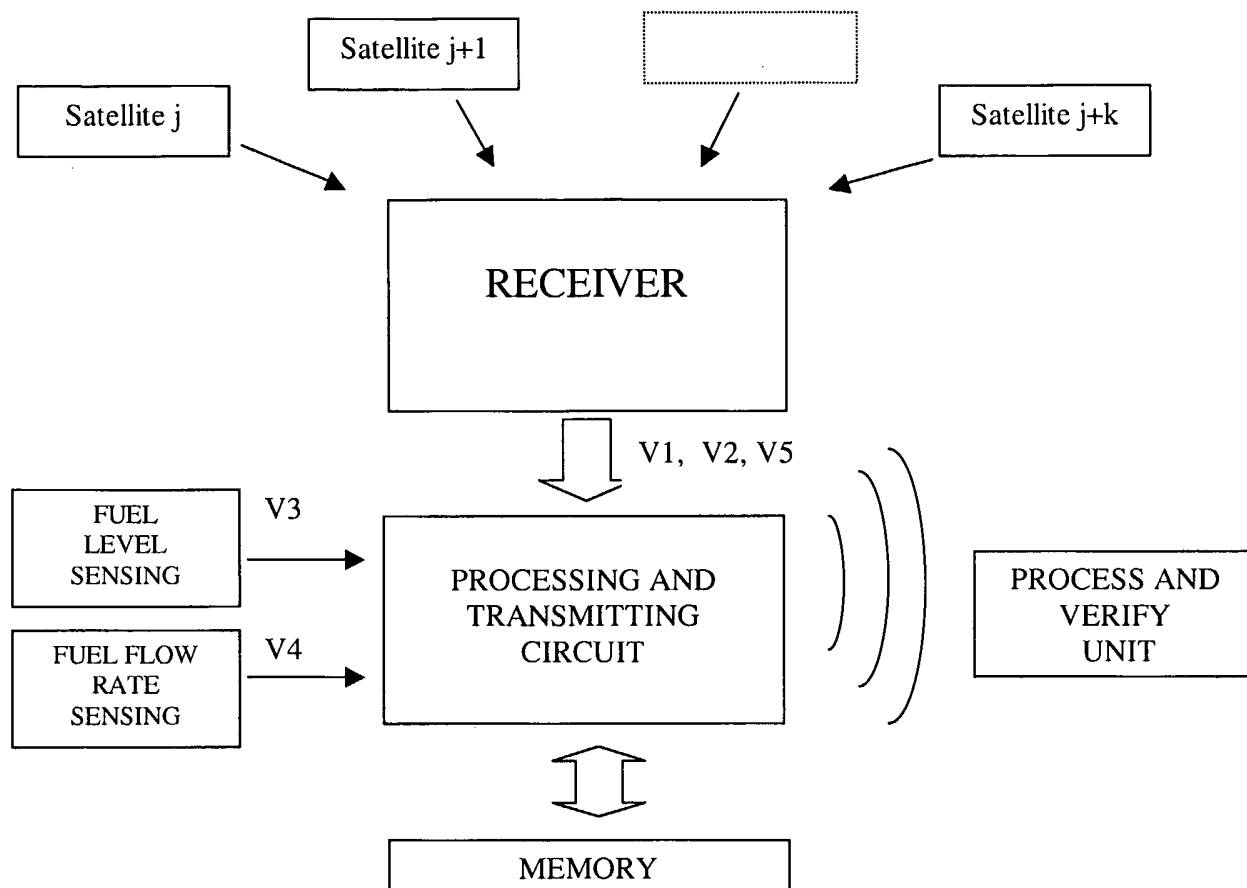
8. System, as claimed in claim 7, characterized in that it includes a data collecting memory (3), which contains sequences of values, each of which defined by said couple
5 of values, said first electric signal (V1) and fourth electric signal (V4), and by said time of measurement (V2), in order to allow the transmission, at regular intervals, of packets including a prefixed quantity of said sequences toward a processing and control central
10 unit (5).

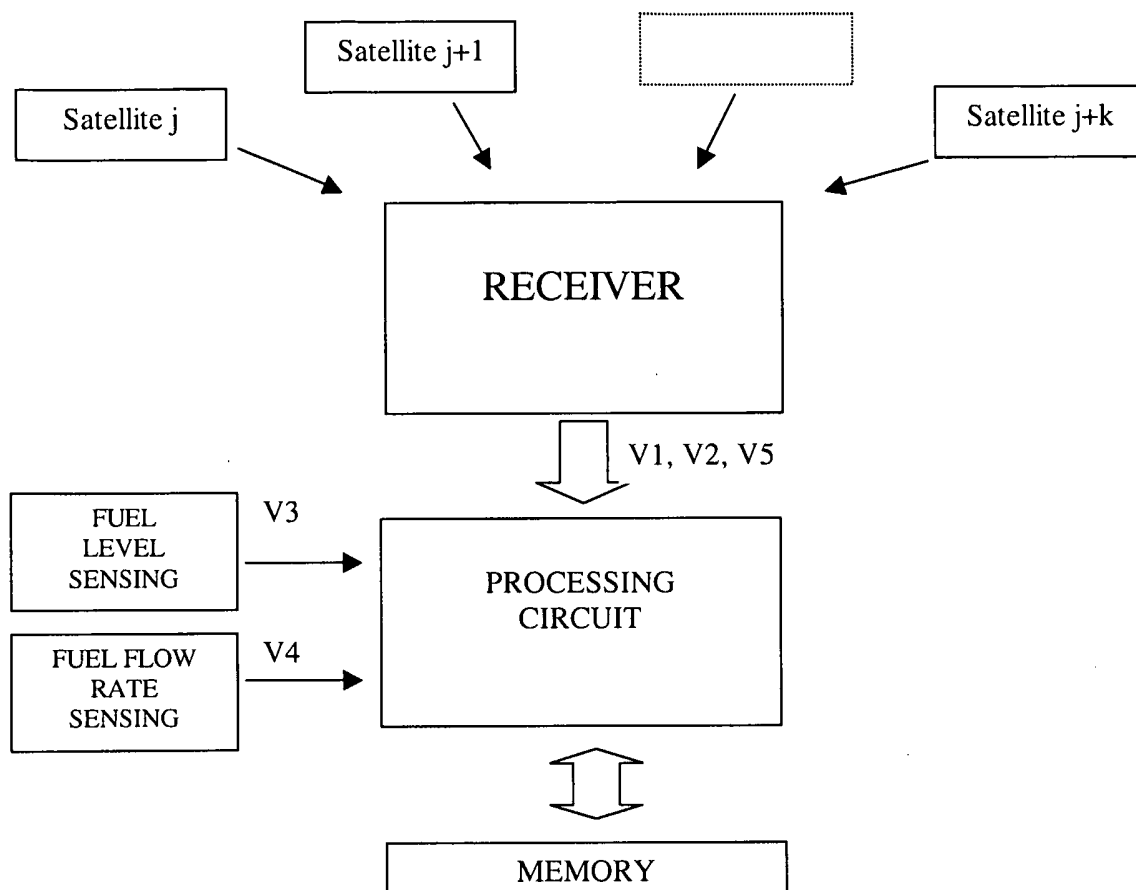
9. System, as claimed in claim 7, characterized in that it includes a data collecting memory (3), which contains sequences of values, each of which defined by said couple
15 of values, said first electric signal (V1) and fourth electric signal (V4), and by said measurement time (V2), in order to allow the acquisition of said sequences by an external memory, with the apparatus standstill.

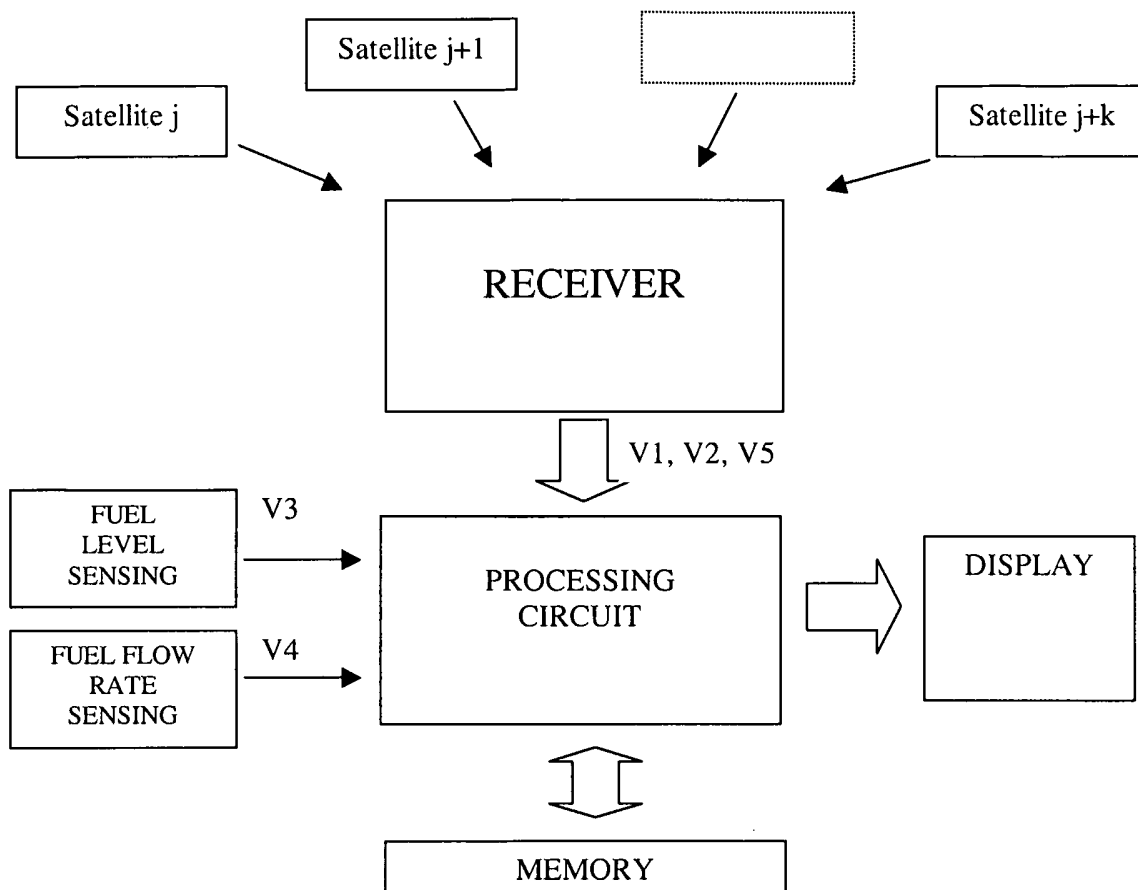
20 10. System, as claimed in claim 1 or 4 or 7, characterized in that said receiver (1) supplies not only said first electric signal (V1) and second electric signal (V2), but also a fifth electric signal (V5) indicating the apparatus speed.

25 11. System, as claimed in claim 3 or 6 or 9, characterized in that it includes a display (6) connected to said device (2), for verifying the way followed by the apparatus and/or to visualize instant or medium fuel
30 consumption.

FIG. 1

FIG. 2

FIG. 3

FIG. 4