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(54) Title: ALUMINIUM ALLOY AND THE UTILIZATION THEREOF FOR A CAST COMPONENT, IN PARTICULAR OF A  
MOTOR VEHICLE

(57) **Abrégé/Abstract:**

The invention relates to an aluminum alloy, in particular a pressure casting alloy, preferably for a cast component of a motor vehicle, with the following alloy elements: 6.5 to <9.5% by weight of silicon, 0.3 to 0.6% by weight of manganese, 0.15 to 0.35% by weight of iron, 0.02 to 0.6% by weight of magnesium, a maximum of 0.1% by weight of titanium, 90 to 180 ppm strontium and aluminum as the remainder, with a maximum of 0.05% by weight, and a total maximum of 0.2% by weight of production-related contaminants. The alloy is particularly suitable for the pressure casting of the cast components of a motor vehicle such as oil pans, for example.

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MOTOR VEHICLE(54) Bezeichnung: ALUMINIUMLEGIERUNG UND DEREN VERWENDUNG FÜR EIN GUSSBAUTEIL INSBESONDERE  
EINES KRAFTWAGENS(57) Abstract: The invention relates to an aluminum alloy, in particular a pressure casting alloy, preferably for a cast component of  
a motor vehicle, with the following alloy elements: 6.5 to <9.5% by weight of silicon, 0.3 to 0.6% by weight of manganese, 0.15 to  
0.35% by weight of iron, 0.02 to 0.6% by weight of magnesium, a maximum of 0.1% by weight of titanium, 90 to 180 ppm strontium  
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contaminants. The alloy is particularly suitable for the pressure casting of the cast components of a motor vehicle such as oil pans,  
for example.(57) Zusammenfassung: Die Erfindung betrifft eine Aluminiumlegierung, insbesondere Druckgusslegierung vorzugsweise für ein  
Gussbauteil eines Kraftwagens mit folgenden Legierungselementen: 6,5 bis <9,5 Gew.-% Silizium 0,3 bis 0,6 Gew.-% Mangan 0,15  
bis 0,35 Gew.-% Eisen 0,02 bis 0,6 Gew.-% Magnesium max. 0,1 Gew.-% Titan 90 bis 180 ppm Strontium und als Rest Aluminium  
mit einzeln maximal 0,05 Gew.-% und insgesamt maximal 0,2 Gew.-% herstellungsbedingten Verunreinigungen. Die Legierung ist  
insbesondere geeignet zum Druckgießen von Gussbauteilen eines Kraftwagens wie beispielsweise von Ölwannen.

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**Aluminium alloy and the utilization thereof for a cast component, in particular  
of a motor vehicle**

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**DESCRIPTION:**

The invention relates to an aluminium alloy, a pressure casting alloy in particular,  
and to the use thereof in a cast component, for a motor vehicle in particular. The  
10 invention also relates to a cast component, in particular for a motor vehicle, made of  
an aluminium alloy of this type.

There are currently generally two options for the production of cast components from  
aluminium-silicon pressure casting alloys for use in the automotive industry in  
15 particular.

One option involves using relatively inexpensive secondary alloys, for example of the  
AlSi10Mg type, which however have a relatively high iron content of approximately  
0.5 to 1.2 % by weight Fe and a low manganese content of approximately 0.1 % by  
20 weight Mn. In this case, it is necessary to have a high iron content in view of, *inter  
alia*, the relatively small amount of manganese added to ensure that the tendency of  
the aluminium alloy to adhere to the pressure casting mould is reduced and the cast  
component produced can be removed from the mould reliably.

25 However, the drawback of secondary alloys of this type is that an intermetallic AlFeSi  
phase is formed in the material structure due to the high iron content, and this phase  
has an extremely large acicular structure which thus causes the cast component to  
exhibit extremely brittle material properties. Furthermore, relatively coarse and  
acicular silicon formation occurs within the AlSi eutectic in this type of aluminium  
30 casting alloy with a high silicon content, and causes a considerable reduction in the  
ductility of the cast component. It is therefore necessary to heat-treat secondary

alloys of this type after removal from the mould in order to obtain appropriately adequate mechanical properties with respect to the hardness and ductility thereof for example. This may, however, result in distortion of the cast components.

5 A cast component produced from a secondary alloy of this type in the form of an oil pan for a motor vehicle is disclosed in EP 0 611 832 B1, in which a local heat treatment process at an appropriate temperature and for an appropriate duration respectively is carried out so as to produce a cast component of different hardnesses. In this case it is provided in particular that the oil pan remains untreated  
10 to the greatest possible extent in the region of a flange, which thus exhibits a hardness of 85 to 110 HB and ductility of 0.5 to 2.5 %, whilst said oil pan is heat-treated appropriately in a base region, resulting in a hardness of 55 to 80 HB and ductility of greater than 4 %. In other words, this is intended to ensure that the high levels of hardness and low levels of ductility respectively already exhibited in the  
15 region of the flange as cast are retained, whereas the hardness is reduced and the ductility increased in the base region in order to reduce the risk of cracks or damage of this type in the oil pan due to stone impact. However, heat treatment of this type is time-consuming and thus costly with the result that any cost savings made by using a secondary alloy, will be more than used up in this process.

20

The alternative option to the aforementioned secondary alloy involves the use of primary alloys, also of the AlSi10 type for example, the residual aluminium of which contains, in addition to the alloying elements, a maximum of 0.05% by weight individually, or a maximum of 0.2 % by weight in total, of production-related  
25 contaminants.

A primary alloy of this type is disclosed in EP 0 997 550 B1 for example and unlike the aforementioned secondary alloys has a lower iron content of 0.15 to 0.35 % by weight Fe and a relatively high manganese content of 0.3 to 0.6 % by weight Mn. In  
30 addition to the fact that a primary alloy of this type has a reduced tendency to adhere to the pressure casting mould and can thus be easily removed from the mould, the

intermetallic AlFeSi phases which are common in secondary alloys do not occur in a primary alloy of this type. Instead, an intermetallic  $\text{Al}_{12}(\text{Mn}, \text{Fe})\text{Si}_2$  phase which is more circular in form is produced for example and therefore does not exhibit any or any pronounced acicular formation. This results in considerably improved morphology so it is possible to produce a material with a hardness of approximately 80 to 100 HB as cast. Strontium, which halts the acicular growth of silicon within the AlSi eutectic, is preferably added to the primary alloy described above in order to reduce the coarse or acicular formation of silicon in said AlSi eutectic.

However, since at least some of the cast components formed from a primary alloy of this type, merely exhibit an elongation at break  $A_5$  of  $< 5\%$  as cast and after removal from the mould, these cast components are initially partially solution heat treated at a temperature of 400 to 490 °C for a duration of 20 to 120 minutes in a subsequent heat treatment process and are then air-cooled, in order to be used as safety components in the automotive industry. This considerably increases the ductility of the cast component so it is possible to obtain an elongation at break  $A_5$  of  $> 12\%$ . The heat treatment causes the hardness of the cast component to sink to a value of approximately 60 to 65 HB.

It is therefore an object of the present invention to provide an aluminium alloy and the use thereof for a cast component, of a motor vehicle in particular, of the type mentioned at the outset, with which a cast component of this type can be produced in a considerably simpler and thus more cost-effective manner. A further object of the invention is to produce a cast component, produced from an aluminium alloy of this type, in particular for the motor vehicle industry, with high mechanical specifications in a simpler and more cost-effective manner.

This invention is achieved according to the invention by an aluminium alloy with the features of claim 1, the use thereof in a cast component, of a motor vehicle in particular, with the features of claim 6 and by a cast component made of an aluminium alloy of this type for a motor vehicle in particular, with the features of claim

10. Advantageous configurations with expedient and non-trivial developments of the invention are specified in the dependent claims.

5 In order to achieve the object according to the invention, the aluminium alloy which is to be used as a pressure casting alloy in particular comprises the following alloying elements:

|          |    |      |                       |
|----------|----|------|-----------------------|
| 6.5      | to | <9.5 | % by weight silicon   |
| 0.3      | to | 0.6  | % by weight manganese |
| 10 0.15  | to | 0.35 | % by weight iron      |
| 0.02     | to | 0.6  | % by weight magnesium |
| max. 0.1 |    |      | % by weight titanium  |
| 90       | to | 180  | ppm strontium         |

15 and aluminium as the remainder, with a maximum of 0.05% by weight individually, and a maximum of 0.2 % by weight in total, of production-related contaminants.

Due to the reduced silicon content, which is lower than in the previously known primary alloy according to EP 0 997 550 B1, the proportion of AlSi eutectic is  
20 considerably reduced and, in contrast thereto, the proportion of aluminium solid solution is increased considerably. The aluminium-silicon alloy according to the invention enables two properties which are opposite *per se* to be combined. On the one hand, it is possible to use the aluminium alloy according to the invention to produce cast components which, upon removal from the mould already as cast, i.e.  
25 without any additional heat treatment, exhibit a hardness of > 80 HB, preferably between 84 HB and 88 HB. It should be noted in this regard that these values are measured in the interior of the cast component, i.e. below the cast skin of the component. On the other hand, the aluminium alloy according to the invention enables a very high level of ductility of the cast component to be obtained, despite  
30 the relatively high hardness, and enables the elongation at break upon removal from

the mould, i.e. as cast and without any further heat treatment, to attain a value of  $A_5 > 5\%$ , preferably between 8 % and 12 %.

Whereas it is necessary for a cast component which is produced from an aluminium alloy according to EP 0 997 0550 B1 and may exhibit a relatively low elongation at break  $A_5$  value of approximately 4 %, to undergo heat treatment in order to obtain the mechanical characteristics required in the motor vehicle construction industry in particular, aftertreatment of this type may therefore be dispensed with for cast components produced from the aluminium alloy according to the invention. Using the aluminium alloy according to the invention ensures that a sufficient level of ductility is achieved, at which the elongation at break  $A_5$  value of the cast component is greater than 5 %. The aluminium alloy similarly ensures that the hardness of the cast component, at  $> 80$  HB, is sufficiently high. It is therefore possible to produce an alloy with which cast components, which exhibit excellent mechanical properties without being heat treated and are accordingly extremely simple and cost-effective to produce, can be produced, for the motor vehicle construction industry in particular.

In one embodiment of the invention, the aluminium alloy according to the invention contains, in contrast to the alloy according to EP 0 997 550 B1, a selected range of between 0.22 to 0.4 % by weight of magnesium, since the hardness of the cast component produced from the aluminium alloy is a function of not only the eutectic, but also of the resulting precipitates. Very fine  $Mg_2Si$  deposits, by which the strength or the hardness of the cast component can be adjusted, are formed as a result of the specifically selected magnesium content. In other words, the hardness of the cast component produced from the aluminium alloy according to the invention is also a function of the magnesium content. It is therefore possible to obtain a particularly high hardness of the cast component made from the aluminium alloy according to the invention if the magnesium content lies in a selected range of between 0.3 and 0.4 % by weight, preferably between 0.32 and 0.36 % by weight, while still maintaining an elongation at break  $A_5$  value of  $> 5\%$ .

In addition, the use of strontium in an amount of between 90 and 180 ppm in the aluminium alloy according to the invention halts the acicular silicon growth within the AlSi eutectic during solidification of the alloy, thus ensuring that the silicon crystals do not take on a very acicular form.

5

It has further proved to be advantageous to add between 0.1 and 0.4 % by weight of copper as a further alloying element to the aluminium alloy according to the invention. This boosts the natural ageing process, by which means it is also possible to influence the hardness of the cast component produced from the aluminium alloy.

10

Since the aluminium alloy according to the invention or the cast component produced therefrom already exhibits, as cast, the aforementioned high levels of hardness and elongation at break respectively, it is very suitable for use in the automotive industry. It has been found to be particularly advantageous to use the aluminium-silicon alloy according to the invention for oil pans for motor vehicles, since it is necessary for oil pans to exhibit a relatively high level of ductility with an elongation at break  $A_5$  of  $> 5\%$  in order to provide adequate resistance to cracking within the oil pan which may be caused in particular by the impact of stones on the bottom of the motor vehicle. Since it is necessary for the oil pans to be fixed in tightly to a respective corresponding engine housing in the connection or flange region, they must exhibit an appropriately high hardness of  $> 80$  HB. Since a cast component produced from the present aluminium-silicon alloy can satisfy these requirements as cast and without any further heat treatment, it is therefore possible to produce an oil pan or another component for a motor vehicle which is simple to manufacture and therefore cost-effective.

25

Since the mechanical properties in terms of hardness and ductility which can be achieved by using the present aluminium alloy are sufficient for use in a large number of cast components employed in the automotive industry, these cast components may now be used without any further heat treatment being required. This is advantageous not only with respect to a simpler and more cost-effective

30

production process, but it is also thus possible to avoid distortion of the cast components which can occur during the heat treatment in a simple manner due to the fact that no after treatment is required.

- 5 The aluminium alloy can be used particularly advantageously in a pressure casting process for producing the cast components, for a motor vehicle in particular, since it is thus possible to produce the cast components particularly rapidly and cost-effectively.
- 10 Should cast components with different mechanical properties, in particular with respect to the ductility or hardness thereof, to those exhibited by cast components as cast be required for use for example in the vehicle body, chassis or as a component of the drivetrain of the motor vehicle, the aluminium-silicon alloy according to the invention used for this purpose may undergo heat treatment after the casting
- 15 process.

In this case, it has been found to be particularly advantageous if the cast component is solution treated in a temperature range of between 400 and 490 °C, in particular between 420 and 460 °C, for a duration of between 20 and 120 minutes, and

20 subsequently air-cooled. This extremely gentle heat treatment and the cooling of the cast component in air ensure in particular that the cast components do not become warped or are not excessively warped.

In order to attain the desired strength level, the component can also be aged

25 artificially in the Mg<sub>2</sub>Si precipitation hardening temperature range after the partial solution treatment. This artificial ageing process is preferably carried out in a temperature range of from approximately 190 to 240 °C, in particular approximately 190 to 220 °C.

- 30 The cast component formed from the new aluminium-silicon alloy is distinguished in particular by the fact that all regions of this component as cast exhibit an at least

approximately uniform hardness of  $> 80$  HB, preferably between 84 and 88 HB. Furthermore, all regions of the component advantageously exhibit an at least approximately uniform elongation at break  $A_5$  of  $> 5\%$ , preferably of  $8\%$  to  $12\%$ .

- 5 Further advantages, features and details of the invention will emerge from the following description of preferred embodiments with reference to the drawings, in which:

Fig. 1 is a process diagram of a heat treatment of a component of a motor vehicle;  
10 and

Fig. 2 is a further process diagram of a heat treatment of a component of a motor vehicle.

15 Example 1:

In this case a plurality of cast components in the form of oil pans for a motor vehicle were produced in a pressure casting process from an aluminium-silicon casting alloy with the following composition:

|    |          |    |      |                       |
|----|----------|----|------|-----------------------|
| 20 | 6.5      | to | <9.5 | % by weight silicon   |
|    | 0.3      | to | 0.6  | % by weight manganese |
|    | 0.15     | to | 0.35 | % by weight iron      |
|    | 0.22     | to | 0.4  | % by weight magnesium |
|    | max. 0.1 |    |      | % by weight titanium  |
| 25 | 90       | to | 180  | ppm strontium         |

and aluminium as the remainder, with a maximum of  $0.05\%$  by weight individually, and a maximum of  $0.2\%$  by weight in total, of production-related contaminants, whereas  $0.1$  to  $0.4\%$  by weight of copper may optionally also be provided. In the  
30 present embodiment, the silicon content is thus between  $7$  and  $9\%$  by weight and the magnesium content is between  $0.32$  and  $0.36\%$  by weight.

After the pressure casting process, tensile samples were removed from the cast components or oil pans and were found to have the mechanical properties listed in the following table:

5

| No. | $R_{p0.2}$<br>N/mm <sup>2</sup> | $R_m$<br>N/mm <sup>2</sup> | $A_5$<br>% | Oil<br>Pan<br>No. |
|-----|---------------------------------|----------------------------|------------|-------------------|
| 1   | 138.91                          | 283.81                     | 8.98       | 35                |
| 2   | 136.06                          | 282.10                     | 10.43      | 35                |
| 3   | 138.22                          | 281.96                     | 9.63       | 35                |
| 4   | 137.98                          | 285.06                     | 9.85       | 35                |
| 5   | 136.79                          | 283.33                     | 10.40      | 37                |
| 6   | 135.41                          | 282.34                     | 10.86      | 37                |
| 7   | 132.61                          | 272.33                     | 9.58       | 37                |
| 8   | 135.34                          | 280.79                     | 8.64       | 37                |
| 9   | 133.01                          | 280.27                     | 10.48      | 52                |
| 10  | 135.23                          | 281.67                     | 11.96      | 52                |
| 11  | 137.56                          | 278.42                     | 9.00       | 52                |
| 12  | 133.48                          | 278.28                     | 8.62       | 52                |
| 13  | 133.80                          | 274.62                     | 8.13       | 54                |
| 14  | 134.47                          | 280.03                     | 11.60      | 54                |
| 15  | 136.96                          | 280.18                     | 10.50      | 54                |
| 16  | 132.54                          | 276.22                     | 8.69       | 54                |

The table shows that all of the samples exhibited an elongation at break  $A_5$  of between 8 and 12 %. The present aluminium alloy is therefore very suitable for use in the production by pressure casting of oil pans, for which an elongation at break  $A_5$  of > 5 % is required in order to prevent in particular the formation of cracks caused by stone impact when the motor vehicle is in motion.

10

In further tests it was also found that the oil pans cast using the present aluminium-silicon alloy exhibit a hardness of  $> 80$  HB, in particular between 84 and 88 HB so the connection or flange region of the oil pans can be fixed tightly to a corresponding engine housing of the motor vehicle. The cast skin of the present oil pans as cast was removed appropriately in a machining operation, for example milling, to ensure that realistic hardness values of the oil pans as cast could be determined.

#### Example 2:

In this case, a plurality of cast components in the form of oil pans for a motor vehicle were again produced in a pressure casting process from an aluminium-silicon casting alloy with the following composition:

|      |    |      |                       |
|------|----|------|-----------------------|
| 7.8  | to | 8.2  | % by weight silicon   |
| 0.5  | to | 0.6  | % by weight manganese |
| 0.15 | to | 0.2  | % by weight iron      |
| 0.27 | to | 0.33 | % by weight magnesium |
| 0.04 | to | 0.08 | % by weight titanium  |
| 140  | to | 180  | ppm strontium         |

and aluminium as the remainder, with a maximum of 0.05 % by weight individually, and a maximum of 0.2 % by weight in total, of production-related contaminants. In the present embodiment, the magnesium content is in particular approximately 0.3 % by weight.

In this case, the individual oil pans were not heat treated. The measured values therefore relate to the components as cast, the cast skin again being removed in the respective sample regions by a machining operation, such as, milling.

| No. | Oil<br>Pan<br>No. | $R_{p0.2}$<br>N/mm <sup>2</sup> | $R_m$<br>N/mm <sup>2</sup> | A<br>% |
|-----|-------------------|---------------------------------|----------------------------|--------|
| 1   | 23                | 120.56                          | 264.79                     | 9.44   |
| 2   | 23                | 124.23                          | 259.44                     | 7.1    |
| 3   | 23                | 122.24                          | 266.08                     | 10     |
| 4   | 23                | 121.06                          | 264.67                     | 10.66  |
| 5   | 34                | 123.21                          | 267.47                     | 12.92  |
| 6   | 34                | 122.87                          | 267.47                     | 11.45  |
| 7   | 34                | 122.74                          | 262.58                     | 8.76   |
| 8   | 34                | 122.24                          | 254.27                     | 6.25   |
| 9   | 48                | 120.84                          | 262.31                     | 9.66   |
| 10  | 48                | 122.74                          | 265.57                     | 12.26  |
| 11  | 48                | 122.02                          | 266.43                     | 14.38  |
| 12  | 48                | 126.5                           | 267.35                     | 12.88  |

|   |  |        |        |       |
|---|--|--------|--------|-------|
| Ø |  | 122.60 | 264.04 | 10.48 |
|---|--|--------|--------|-------|

5 The table shows in particular that the oil pans in this case exhibited values for tensile  
 strength  $R_m$  greater than 250-260 N/mm<sup>2</sup>, proof stress  $R_{p0.2}$  greater than 120 N/mm<sup>2</sup>  
 and elongation at break  $A_5$  in the range between 6.25 and 14.38 %. The present  
 aluminium alloy therefore proved itself to be particularly suitable for use in the  
 production by means of pressure casting of oil pans, in which an elongation at break  
 10  $A_5$  of > 5 % must be attained. It was also possible to achieve a hardness of > 80 HB  
 with this alloy composition.

### Example 3:

The present example is based on a test programme which was carried out on  
 components in the form of door pillars or B pillars for cars. These door pillars should

thus exhibit a proof stress  $R_{p0.2}$  of 150 to 180 MPa and an elongation at break  $A_5$  of = 7 %.

In this case, the B pillars were produced in a pressure casting process from two  
5 variants of an aluminium-silicon alloy with the following compositions:

Variant 1:

7.8 to 8.2 % by weight silicon  
0.5 to 0.6 % by weight manganese  
10 0.15 to 0.2 % by weight iron  
0.27 to 0.33 % by weight magnesium  
0.04 to 0.08 % by weight titanium  
140 to 180 ppm strontium

15 and aluminium as the remainder, with a maximum of 0.05 % by weight individually, and a maximum of 0.2 % by weight in total, of production-related contaminants.

Variant 2:

7.8 to 8.2 % by weight silicon  
20 0.5 to 0.6 % by weight manganese  
0.15 to 0.2 % by weight iron  
0.5 to 0.6 % by weight magnesium  
0.04 to 0.08 % by weight titanium  
140 to 180 ppm strontium

25

and aluminium as the remainder, with a maximum of 0.05 % by weight individually, and a maximum of 0.2 % by weight in total, of production-related contaminants.

It is thus evident that the two variants differ substantially with respect to their different  
30 magnesium contents, namely with 0.27 to 0.33 % by weight in variant 1 and 0.5 to 0.6% by weight in variant 2.

Heat treatment:

## Process 1:

The two variants of the aluminium-silicon casting alloy, and more specifically variant  
5 2 with a magnesium content of approximately 0.6 % by weight, were in this case  
subjected for example to the following heat treatments which are described with  
reference to the process diagrams in Figs. 1 and 2:

Fig. 1 shows a method in which the B pillars (product P), after being cast in step 1,  
10 are solution treated in step 2, making use of some of the casting heat, and are then  
air-cooled by means of a fan. In other words, after being removed from the mould,  
the product P is not cooled, to room temperature for example, but is instead solution  
treated at a temperature of approximately 200 °C in step 2. A sprue A or other  
casting residues remain on the product P during the solution treatment in step 2.

15

After the solution treatment in step 2, the component is still relatively soft or ductile  
and can therefore be deburred in step 3. In this process the sprue A or other casting  
residues are removed from the product P. The product P remains soft during this  
process.

20

After the deburring process carried out in step 3, the B column or the product P is  
straightened in step 4. The product P remains soft for this purpose.

25

Finally, in step 5, the product P is subjected to precipitation hardening, more  
specifically at one of the precipitation hardening temperatures which shall be  
described in further detail below. The product, which is soft until after step 4, then  
obtains its desired material properties.

## Process 2:

Fig. 2 shows a process which differs from that in Fig. 1 in particular in that the order of steps 2 and 3 is swapped and therefore this process does not make use of some of the casting heat.

5

After step 1, the product P is therefore cooled to room temperature or approximately 20 °C together with the gate A or other casting residues. The sprue and casting residues are subsequently deburred 3 or removed, the product still being soft during this process.

10

After the deburring process 3, the solution treatment process 2 and subsequent cooling, for example with air by means of a fan, are carried out. The product P remains soft during this process.

15 Steps 4 and 5, i.e. straightening and precipitation hardening of the B pillar or product P at one of the precipitation hardening temperatures which shall be described in greater detail below, are subsequently performed in a manner similar to that of the process in Fig. 1. After step 5, the product, which is soft until after step 4, again attains its desired material properties.

20

A common feature of both methods according to Fig. 1 and Fig. 2 is that in both processes a dimensional test is carried out at point Q1 and a strength test or tensile test is carried out at point Q2.

25 The solution treatment carried out in step 2 of the two processes according to Fig. 1 and Fig. 2 respectively was carried out at different temperatures of between 460 and 490 °C and for different treatment durations of between 15 and 120 minutes in different tests.

30 The precipitation treatment carried out in step 5 of the two processes according to Fig. 1 and Fig. 2 respectively was also carried out at different temperatures of

between 160 and 240 °C and for different precipitation durations of between 20 and 240 minutes in different tests.

5 The heat treatment produced components for use for example in the vehicle body, chassis or drivetrain of a motor vehicle which exhibited values for proof stress  $R_{p0.2}$  of between 90 and 180 MPa, tensile strength  $R_m$  of between 180 and 250 MPa and elongation at break  $A_5$  in the range between 8 and 22 %. The present aluminium alloy is therefore once again particularly well suited for use in a motor vehicle.

10 Example 4:

The present Example is based on a test programme in which high-strength car components with an alloy composition according to variant 1 (0.27 to 0.33 % by weight Mg) are processed in such a way that said components have a proof stress  $R_{p0.2}$  of = 180 MPa after the heat treatment described below.

15

For this purpose the high-strength components were subjected to a T5 heat treatment at different temperatures of between 160 and 240 °C and for different durations of between 20 and 240 minutes.

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**Aluminium alloy and the utilization thereof for a cast component, in particular  
a motor vehicle**

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**CLAIMS:**

1. Aluminium alloy, in particular a pressure casting alloy, preferably for a cast component of a motor vehicle, characterised by the following alloying elements:

|          |    |      |                       |
|----------|----|------|-----------------------|
| 6.5      | to | <9.5 | % by weight silicon   |
| 0.3      | to | 0.6  | % by weight manganese |
| 0.15     | to | 0.35 | % by weight iron      |
| 0.02     | to | 0.6  | % by weight magnesium |
| max. 0.1 |    |      | % by weight titanium  |
| 90       | to | 180  | ppm strontium         |

and aluminium as the remainder, with a maximum of 0.05 % by weight individually, and a maximum of 0.2 % by weight in total, of production-related contaminants.

2. Aluminium alloy according to claim 1,  
characterised in

that said alloy, as cast, exhibits a hardness of > 80 HB, preferably between 84 HB and 88 HB.

3. Aluminium alloy according to either claim 1 or claim 2,  
characterised in

that said alloy, as cast, exhibits an elongation at break  $A_5$  of > 5 %, preferably of 8 % to 12 %.

4. Aluminium alloy according to any one of claims 1 to 3,

characterised in

that said alloy contains 0.1 to 0.4 % by weight of copper as a further alloying element.

5. Aluminium alloy according to any one of claims 1 to 4,  
characterised in

that said alloy contains 0.22 to 0.4 % by weight, preferably 0.32 to 0.36 % by weight, of magnesium.

6. Use of an aluminium alloy according to any one of claims 1 to 5 in a cast component, in particular an oil pan of a motor vehicle.

7. Use according to claim 6,  
characterised in

that the cast component is produced in a pressure casting process.

8. Use according to either claim 6 or claim 7,  
characterised in

that the cast component is subjected to a heat treatment process after the casting process.

9. Use according to claim 8,  
characterised in

that the cast component is partially solution treated in a temperature range of from 400 to 490 °C, in particular in a temperature range of from 420 to 460 °C, for a duration of from 20 to 120 minutes, and is subsequently air-cooled.

10. Cast component, in particular for a motor vehicle, which is produced from an aluminium alloy according to any one of claims 1 to 5.

11. Cast component according to claim 10,

characterised in

that said component is formed as an oil pan for a motor vehicle.

12. Cast component according to either claim 10 or claim 11,

characterised in

that all regions of said component as cast exhibit an at least approximately uniform hardness of  $> 80$  HB, preferably between 84 HB and 88 HB.

13. Cast component according to any one of claims 10 to 12,

characterised in

that all regions of said component as cast exhibit an at least approximately uniform elongation at break  $A_5$  of  $> 5\%$ , preferably of  $8\%$  to  $12\%$ .

14. Cast component according to claim 13,

characterised in

that said cast component is at least partially solution treated in a temperature range of from  $400$  to  $490\text{ }^{\circ}\text{C}$ , in particular in a temperature range of from  $420$  to  $460\text{ }^{\circ}\text{C}$ , for a duration of from 20 to 120 minutes and subsequently air-cooled.

1/1

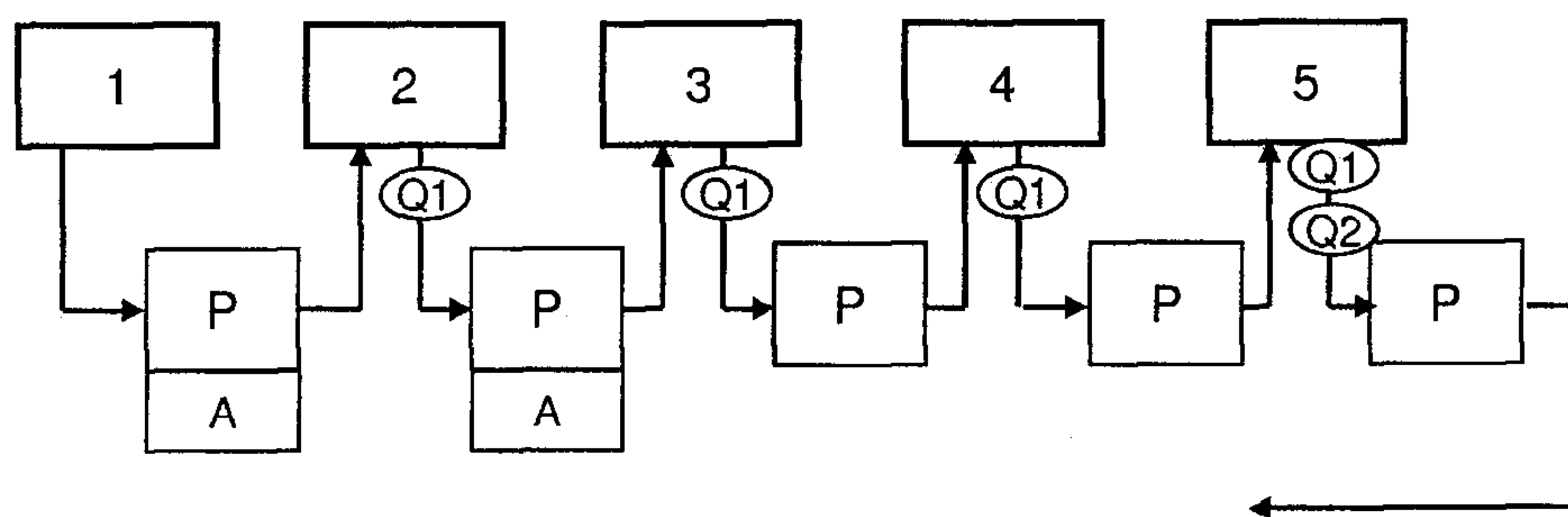


Fig.1

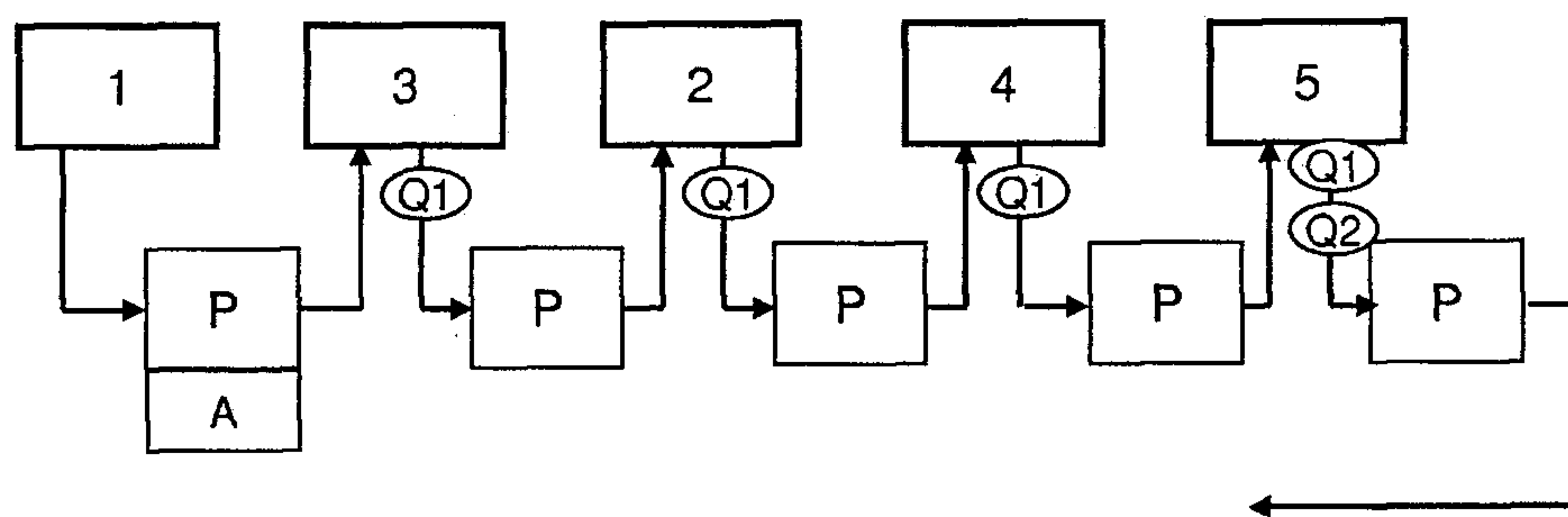


Fig.2