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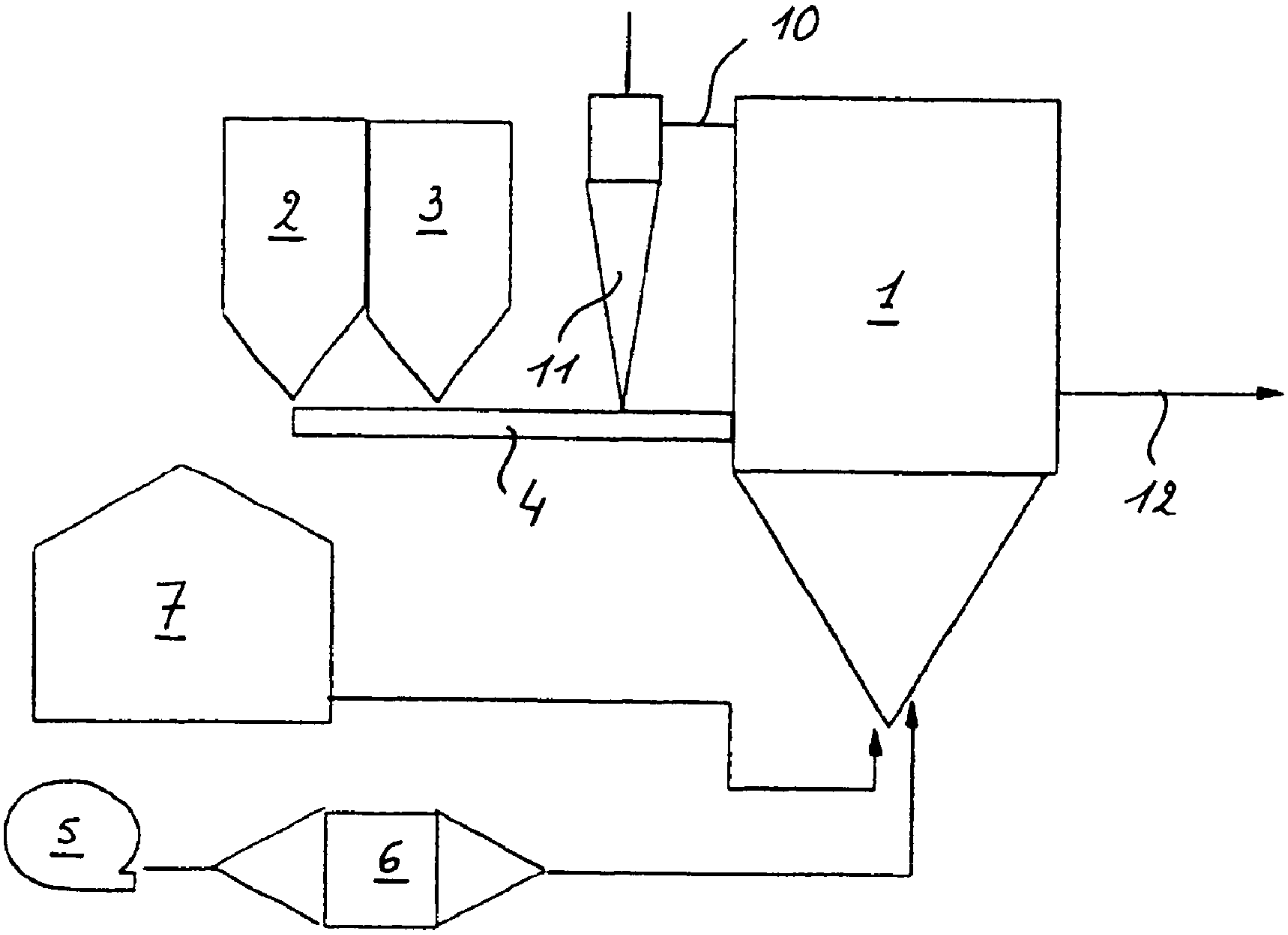
(54) Title: FERTILISER ADDITIVE COMPRISING MAGNESIUM AND CALCIUM SULPHATE AND CARBONATE



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Chemical composition to be used as additive for fertiliser composition, comprising 35 - 60 % by weight of magnesium sulphate, 5 - 35 % by weight of calcium sulphate, 10 - 35 % by weight of a mixture containing magnesium carbonate and calcium carbonate up to 5 % by weight of water, either free or bound as crystal water, and the balance magnesium oxide.

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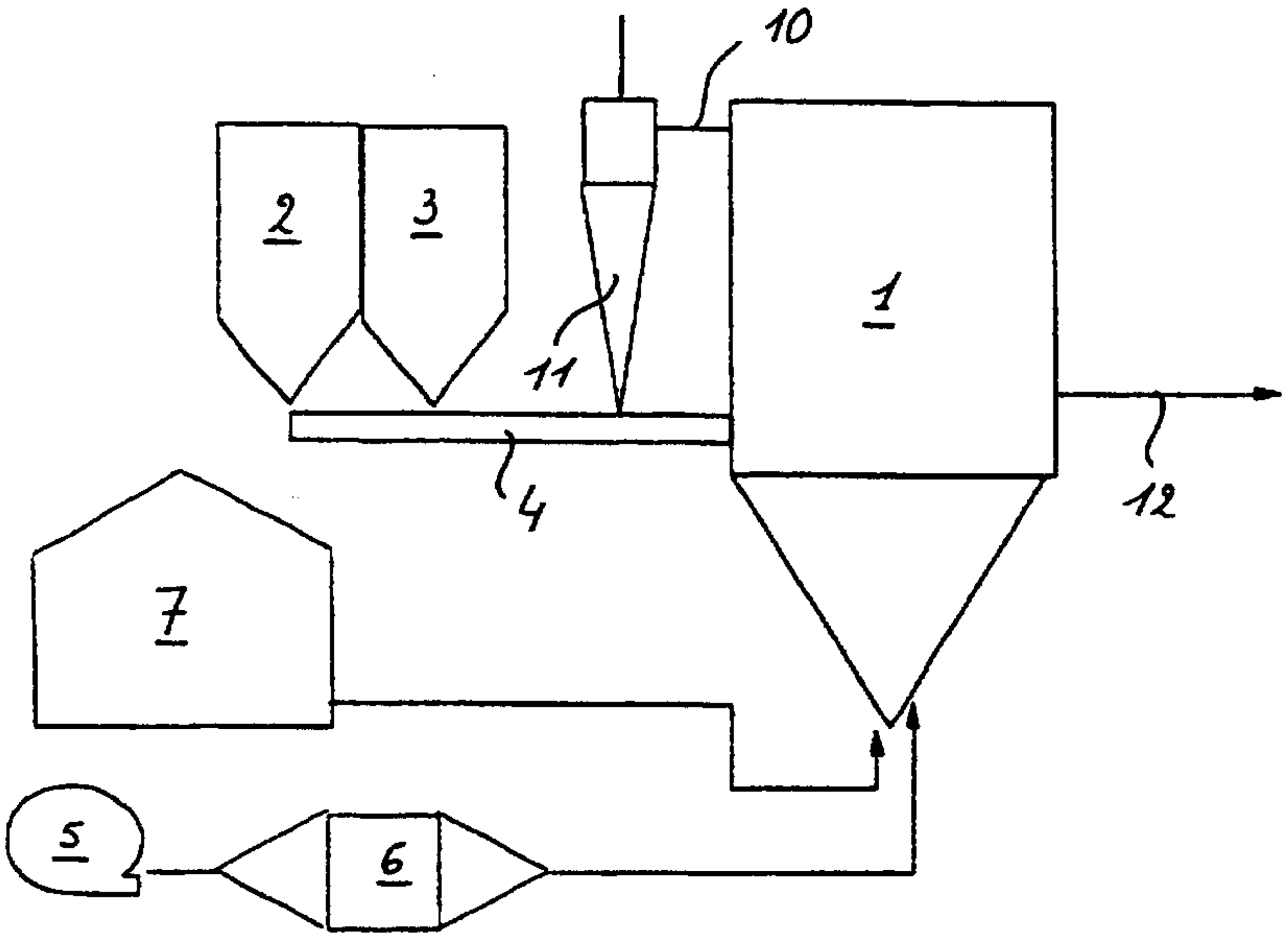
(54) **Title:** FERTILISER ADDITIVE COMPRISING MAGNESIUM AND CALCIUM SULPHATE AND CARBONATE



(57) **Abstract:** Chemical composition to be used as additive for fertiliser composition, comprising 35 - 60 % by weight of magnesium sulphate, 5 - 35 % by weight of calcium sulphate, 10 - 35 % by weight of a mixture containing magnesium carbonate and calcium carbonate up to 5 % by weight of water, either free or bound as crystal water, and the balance magnesium oxide.

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FERTILISER ADDITIVE COMPRISING MAGNESIUM AND CALCIUM SULPHATE AND CARBONATE

The invention relates to a chemical composition to be used as granulation additive for a fertiliser composition.

The last few years in agriculture the need for water soluble magnesium and the need for sulphur have increased. Magnesium in grass is a requirement to prevent diseases in cattle, due to a Mg-deficiency which is the consequence of the application of manure. Sulphur is a main nutrient which became scarce due to environmental regulations for flue gas desulphuristion, and therefore less deposit on the ground.

A possible answer to fulfil these magnesium and sulphur need is a fertiliser to which mineral kieserite has been added. Natural kieserite contains as an average 97 % by weight $MgSO_4.1H_2O$ and some 3 % by weight impurities. Although the use of mineral kieserite to fertiliser leads to an acceptable product, a number of problems are still present. First at all there are the impurities, which can generate a number of problems in the process. Mostly these impurities contain chlorides which in a number of processes have a negative influence either on the security or on environmental issues. Further it is not always possible to adjust the balance between Mg and S while maintaining the level of water soluble Mg in the composition.

Furthermore there is a need for having Mg available as in a quick soluble composition such as $Mg\ SO_4$, and in a slow release composition, such as MgO or $Mg\ CO_3$.

The invention provides a chemical composition which can be used as additive for fertilisers composition which avoids the above mentioned difficulties.

This is obtained in that the composition comprises 35 - 60 % by weight of magnesium sulphate, 5 - 35 % by weight of calcium sulphate, 10 - 35 % by weight of a mixture containing magnesium carbonate and calcium carbonate, up to 5 % by weight of water either free or bound or crystal water, and the balance being magnesium oxide.

By the use of this composition sulphur is made available as well as magnesium, and the magnesium is present in different forms, either as $MgSO_4$, which is readily soluble, as MgO, which can be converted into $MgNO_3$ by reaction with N-containing fertiliser, which is less soluble and as $MgCO_3$ in which is relatively slow soluble.

The amount of $MgSO_4$ can be varied between 35 and 60 % by weight, dependent upon the ultimate goal of the presence of this product. High amounts of $MgSO_4$ are required if the coating characteristics of the ultimate product must be increased, and special characteristics are required such as hardness or anti-caking surfaces. In such case the amount of $MgSO_4$ must be at least 40 % by weight preferably between 50 - 60 % by weight and most preferably between 50 - 55 % by weight.

Otherwise if the nutrient characteristics must be improved, it might be preferred to use lower amounts of $MgSO_4$. In such case the $MgSO_4$ content must be below 55 % by weight, preferably between 35 - 45 % by weight and most preferably between 40 - 45 % by weight.

The amount of Ca SO_4 is between 5 - 35 % by weight, but also the amount can be varied dependent upon the required characteristics of the ultimate product. If the high nutrition is a requirement the amount of $CaSO_4$ must be kept low, preferably at most 20 % by weight. Otherwise if the coating characteristics and mechanical properties of the ultimate product are important it is recommended to keep the amount of $CaSO_4$ higher preferably at least 15 % by weight.

The amounts of the carbonates, $MgCO_3$ and $CaCO_3$ as such are not very critical, as these products only serve an inert filler material. These compounds can be used to adjust the relationship between the amounts Mg and S added to the ultimate products.

It is also possible to adjust the amount of MgO present in the chemical composition according to the invention. If the nutrition value of the ultimate product is important it is preferred to keep the amount of MgO below 5 % by weight. This is especially important as MgO has the tendency to react with ammonia-based fertilisers. Otherwise if the coating characteristics of the final product are important it is preferred to keep the amount of MgO between 2 - 8 % by weight.

The invention also relates to a process for preparing such a chemical composition.

An obvious process for preparing this chemical composition is the so-called wet route, which is based upon a suspension reaction of sulphuric acid with magnesium carbonate. The obtained magnesium sulphate solution has to be dried subsequently by means of any conventional drying process, e.g. spray drying techniques. This process however was not very practical because of the corrosion during the production of the magnesium sulphate, which was mainly due to the temperature and the sulphuric acid-water-mixture. Moreover the formation of so-called bittersalt ($MgSO_4.7H_2O$), makes the obtained product not suitable for all further applications, especially slurry granulation.

The invention also provides a process of preparing a chemical composition whereby the above mentioned problems are avoided.

This process is characterised in that magnesium oxides, magnesium carbonate and/or calcium carbonate are mixed with sulphuric acid in a fluid bed reactor which is driven with air, and the resulting chemical composition is removed from the fluid bed reactor.

In this way it was possible to have a sufficient reaction between the solids and the sulphuric acid to have a complete reaction and obtain the desired composition.

The main reaction taking place in the fluidised bed reactor is between MgO and H_2SO_4 resulting in the formation of $MgSO4_2$ and water. There is only a limited reaction between the carbonates of calcium and magnesium with sulphuric acid. The reaction between MgO and H_2SO_4 is an exothermic reaction, but the heat generated is insufficient to maintain the reaction temperature at a level which is sufficient to keep the reaction running. For that reason the air used to operate the fluidised bed can be preheated, whereby the reaction speed is increased and the reaction becomes self-sustaining.

Preferably the air is preheated to a temperature between 110°C and 200°C, more preferably between 120°C and 180°C, and most preferably the temperature is maintained below 150°C.

In this way the air temperature is substantially equal to the reaction temperature, so that the reaction as such is not disturbed. In fact this temperature is a compromise between the heat generated by the reaction and the heat exchange with the environment.

In order to optimize the reaction between H_2SO_4 (a liquid) and the magnesium compounds (MgO or $MgCO_3$) (solids) it is required to have a specific particle size. This is needed on the one side to have a stable fluidised bed, but otherwise to have sufficient reaction surface, to perform the conversion within acceptable time limits.

For that reason the particle size of magnesium oxide and/or magnesium carbonate is defined as 90 % by weight smaller than 100 μm and 40 % by weight smaller than 30 μm.

The reaction time between MgO and H_2SO_4 is preferably longer than 8 minutes, thereby ensuring that together with post-reaction a sufficient conversion of MgO has taken place. More preferably the reaction time is longer than 10 minutes.

The process will now be described with reference to annexed Figure 1, which is a schematic representation of an installation which can be used for the application of the process according to the invention.

The installation comprises a fluid bed reactor 1. Two supply hoppers 2 and 3 are provided for MgO and Dolomite respectively, and a transport system 4 such as a screw supplies both these components into the reactor. Air is supplied by a compressor 5 and supplied through a preheating unit 6 to the bottom of the reactor 1. The air is used as atomisation air in a venturi-type configuration, i.e. the air input in the bottom of the reactor is co-axial with the sulphuric acid input, and completely surrounding the same. In this way very finely divided droplets of sulphuric acid are introduced into the reactor.

A container of sulphuric acid 7 can be connected to the bottom part of the reactor 1, so that it can be supplied together with the preheated air. In the upper part of the reactor an outlet 10 has been provided which ends in the top of a cyclone device 11, the outlet of which being connected to the transport system 4. Another outlet 12 is used for removing product from the reactor. The top of the cyclone is connected to a scrubber (not shown) whereby air can be removed from the reactor 1 and the cyclone device 11.

The spouted air should be supplied in such an amount, that no solids can fall into the undercasing (minimum velocity). The maximum velocity is given by the fact that still a certain bed height is necessary for reaction. Because of the fluidised bed of solids, no acid can come in contact with the fluid bed reactor walls. The bed acts as protector against corrosion. Also when the recycle is too large (circulating bed) too much cooling may occur which might not be in optimal equilibrium with the heat of reaction and further conversion of the reactants. The minimum amount of inert that should be present, should divide all liquid equally in the mixture and should promote reaction-water transfer into the gas, out of the reactor. This in order to prevent negative effects of the water present, like corrosion, cooling, agglomeration. The maximum of this 'inert' present is given by the conversion rate of the base and the heat of reaction that occurs which can be used for upgrading the inert.

The central unit is the Spouted Bed reactor. This reactor can have a one or multi spout reactor, depending on the required capacity. Spout air (fluidisation) is supplied via venturi's forming the bottom. In the centre of these venturi's liquid two-phase nozzles are mounted centrally. One to all venturi's can be equipped by such a nozzle. Acid is supplied by a pump from a tank to these nozzles. The acid should be atomised by gas (preferably air or a base gas). Depending on the type of nozzle the pressure to spray the acid can vary. End product can be withdrawn from the bed centrally form the bottom. Any other place at the bed is also possible (e.g. other place at bottom or side walls). Product withdrawal from the recirculation loop is also possible. The materials in the spouted (fluidised) bed can circulate over the bed and a dedusting unit (filter or cyclone). The product can be recycled into the bed either via a mechanical (screw) or pneumatical device. A rotary valve may be necessary. Solid product supply (base and /or inert) can be supplied at several places in the bed. The solid base material should preferably be supplied as close as possible to the acid supply. Both products can be fed into the bed either mixed or single. Supply can be done pneumatically or via mechanical dosing equipment. Rotary valves may be necessary to prevent leaking.

The end product should be given residence time in order to promote post reaction to obtain a good product quality. Residence time can be given in a normal bin or in more sophisticated devices like e.g. temperature controlled devices and/or degassing devices. Product should be kept in movement in order to prevent blocking of the system due to post reaction effects. After post reaction (a part of) the product can be brought into the right particle size distribution. Mechanical or pneumatical devices are possible tools to achieve a classification. A combination of classification and cooling might be a possibility.

The end product should be directly compatible with the Hydro Fluid Bed Granulation process. The compatibility can be achieved anywhere in the fluid bed granulation. Both front end (slurry granulation) and back end (recycle granulation, coating end product) supply are possibilities. The end product is suitable in the same way with other fertiliser granulation processes.

An example of the liquid - solid reaction can be the conversion of magnesium oxide with sulphuric acid into the secondary and micro nutrient magnesium sulphate. As inert dolomite (equimolar mixture of calcium and magnesium carbonate) is used. The heat of reaction is used for the evaporation of water and to initialise the conversion of dolomite into magnesium sulphate and calcium sulphate. The acid is supplied in excess of the magnesium oxide. However not all dolomite should be converted, because of its function as reaction medium for heat and mass transfer. The acid is supplied via a two-phase nozzle which takes care of the formation of fine droplets. The atomisation air is cold in order to prevent corrosion due to warm sulphuric acid.

The invention also relates to a fertilizer which is characterised in that prior to granulation the fertilizer has been mixed with the chemical composition according to the invention.

In case the chemical composition described above is mixed with a fertilizer composition prior to or during the granulation thereof, it is possible to mix other chemical substances with the chemical composition in order to add other useful compounds to the fertilizer composition. A requirement is that there is no chemical reaction between the fertilizer, the chemical composition and the added chemical substance and that the added chemical substance is stable enough to be submitted to the granulation process.

Good examples of such chemical substances are micro nutrients, especially oxides, hydroxides or carbonates of metals such as Zinc, Manganese or Copper although also other stable substances can be added as well, such as primary nutrients. Example of such primary nutrients are phosphate rock as for example fluorapatite, ammonium phosphates. Such as di-ammonium phosphate or mono-ammonium phosphate and potassium salts such as potassium chloride or ptasium sulphate.

Further the invention also relates to fertilizer granules which are characterised in that the granules are coated with the chemical composition according to the invention.

Further the invention relates to such a fertilizer in which the coating is filled with one or more other chemical substances selected from the group of primary or secondary nutrients, micro-nutrients, nitrification inhibitors, slow release controlling agents, biostimulants, pesticides, herbicides, fungicides or living organisms, vitamins, marine based products, amino acids, metalchelates of Zn, Mn Fe or Cu.

In case the coating is applied at room temperature any other chemical composition can be added to the coating provided it will not react with the coating composition and / or the fertillizers, which means that practically any inert composition can be added. In case the coating is not applied at room temperature, but at more elevated temperature care must be taken that no reaction between the coating and / or the fertilizer and the added chemical composition will take place.

Examples of such chemical substances are :
Nutrients

- primary nutrient(s), as in common terminology is N, P and K, the nutrient(s)may be, phosphate rock as for example fluorapatite, ammonium phosphates as for example, di-ammonium phosphate and monoammoniumphosphate, potassium salts as for example potassium chloride or potassium sulphate.

- Secondary nutrient(s), as in common terminology is S, Mg and Ca and a may be for example in addition to the compounds described (magnesium sulphate, magnesium oxide, magnesium carbonate, calciumcarbonate, calciumoxide, calsiumsulphate, dolomite) elemental sulphur and sodium chloride.

- Micro nutrient(s), as in common terminology is the compounds of Zn, Mn, Cu, Co, Se, Mo, Si, Fe and B may be the oxide, sulphate, chloride or carbonate salts or other forms of the mentioned elements as for example, zinc oxide, zinc sulphate, zinc carbonate, manganese oxide, manganese sulphate, manganese carbonate, manganesechloride, copper oxide, copper sulphate, cobalt sulphate, cobalt carbonate, cobalt hydroxide, sodium selenate, ammoniummolybdate, sodium molydenum, sodium silicate, ferric oxides (for example hematite, magnetite), ferric carbonate (siderite), ferric sulphide, ferrous ammonium phosphate, ferrous ammonium sulphate, orthoboric acid, disodiumtetraborate, disodium octoborate tetrahydrate, calcined ulexite, metaoric acid, tetraboric acid, boric oxide, calciummetaborate, calcium tetraborate, borax decahydrate and the chelated forms of the elements Zn, Mn, Cu, Fe, the chelating agent being for example EDDHSA, EDDHAS, DTPA, LPCA, HEDTA, natural chelators; gluconates.

Since the technique allows for coating of prills or granules under very mild conditions, also many other categories of additives can be fixed to the fertiliser without risk of the additives being deteriorated as for example:

Natural products

- Natural organic chemicals, e.g. biopolymers of plant or animal origin, natural fungicidal, herbicidal or insecticidal compounds as for example: Natural plant growth regulators, sugars, fatty acids, polysaccharides such as alginate or chitosan, natural resins, natural complexing agents such as carboxylic acids, amino acids, humic acids, phenols.

- Organic materials of compost, fermentation, plant or animal origin such as extracts as for exaple algal extracts, digests, meals, byproducts from plant material or animal processing.

- Live microorganisms or microbial spores fo fungal or bacterial origin

Synthetic compounds or simi-synthetic mixtures

- Crop protection agents such as Quaternary ammonium compounds, Tertiary sulfonium compounds, carbamates, aromatic comounds, pyrethoriods, pheromones, organophosphates, amino-compounds, polyaminocompounds.

- Synthetic chelators, ion exchange agents and polymers such as iminocarboxylic acids, polyamines, polyacrylates, polyols, polycarboxylic acids, polyamino acids.

- Nitrification inhibitors as for example 2-chloro-6 (trichloromethryl)-pyridine, DCD (dicyandiamide), 1-carbaomyl-3-methylpyrazole, 3MP (3-methylpyrazole).

Slow release agent(s)/polymer(s)

methylene urea, starch and starch derivatives (as for example potato starch), cellulose and cellulose derivative (as for example methylcellulose, ethyl cellulose, cellulose acetate, carboxymethl cellulose, cellulose esters), guar (as for example phosphorylated guar).

It should be mentioned that the listing of the groups of substances and examples in the given groups is illustrative, and not restrictive, with respect ot the group of substances that can be added to the coating.

The invention also relates to a process for preparing such fertilizer granules. In the process the following composition is fed to a coating device:

1. fertilizer granules;

2. a chemical composition according to the invention;
3. an amount of water, and optionally;
4. amounts of one or more chemical substances selected from the group of primary or secondary nutrients, micro-nutrients, nitrification inhibitors, slow release controlling agents, biostimulants, pesticides, herbicides, fungicides or living organisms, amino acids, vitamins marine-based products, metal chelates, and the coated fertilizer granules are removed from the coating device.

The invention will now further be explained by means of the following examples.

Example 1

In an apparatus as described above the following chemical components, were used MgO obtained by caustic calination of Magnesium with a specific surface of 10 to 15 m^2/gr. The average particle size was 20 μm (Mediam diameter), with 99% by weight smaller than 90 μm.

$MgCO_3$ and $CaCO_3$ as mixed dolomite having an equimolar composition of Mg and Ca. The particle size was defined as being 90 % by weight smaller than 100 μm and the amount of impurities was less than 4 % by weight.

Sulphuric acid was used in a commercial grade of 90 %.

The process conditions were .

Spouted air :	flow	500 Nm^3/ hr
	pressure	0,13 barg
	temperature	140° C

Atomisation air, i.e. air to be used to break the flow of sulphuric acid into small droplets.

flow	45 Nm^3/ hr
pressure	4,0 barg
temperature	10°C

Raw materials input flow.

MgO	75 kg / hr	
Dolomite	300 kg / hr	
Sulphuric acid	190 l / hr	(pressure of 1,4 barg)

Spouted bed : the temperature in the top of the reactor was 130°C.

Output flow:	flow	550 kg / hr
	temperature	74°C
	recycling + input (in 4)	1300 kg / hr
	temperature at input	74°C

In a number of successive tests the following compositions have been obtained.

Table 1

	MgO	dolomite	MgSO4	CaSO4	Balance
1	4.4	46.3	35.2	12.9	1.3
2	6.7	37.8	35.6	14.8	5.0
3	4.7	24	42.1	15.8	13.4
4	6.8	22	43.1	13.2	14.9
5	9	28.5	41.3	10.5	10.6
6	8.1	18.5	47.1	12.3	13.9
7	2.1	16.2	52.3	15.8	13.6
8	7.7	19.6	44.6	14.2	13.9
9	4.3	13.1	50.7	21.5	10.5
10	6.7	30.5	37.2	14.4	11.2
11	7.8	19.4	39.5	16.9	16.4
12	4.3	32.1	35.4	10.8	17.4
13	3.6	30	38.9	8.7	18.9
14	6.5	25.1	39.5	10.6	18.3
15	16.3	21.3	28.2	12.5	21.7
16	6.5	32.8	35.7	7.9	17.1
17	6	26.6	38.7	8.7	20.1
18	3.4	18.6	42.1	19.2	16.7
19	1.2	19.2	46.1	18.8	14.7
20	5.2	16.8	41.8	18.9	17.3
21	5.1	25.7	36.6	16.7	16.0
22	1.4	39	30.8	13.6	15.2
23	2.6	34.5	36.2	12.7	14.0
24	4.5	31.5	37.7	10.7	15.5
25	4.5	31.5	37.7	10.7	15.5
26	6.7	19.4	35.9	15.6	22.4
27	4.3	28.6	37.5	12.1	17.5
28	0	12.9	53.4	21.2	12.5
29	3	23.5	46.3	11.2	15.9
30	3.7	21.7	45.5	12.5	16.6

31	6.5	19.4	43.2	10.5	20.5
32	1.7	26.1	44.6	11.6	16.1
33	2.2	22.1	47.8	11.4	16.6
34	0	23.9	48.1	12.2	15.9
35	1.1	15.7	54	7.8	21.3
36	5.3	8.6	46.4	31.4	8.4
37	3.8	27.7	41.2	10	17.2
38	7.1	16.2	45	9.4	22.2
39	3.5	26.5	44.6	7.8	17.6
40	4.8	27.5	39.3	11.7	16.7
41	8.1	16.3	42.2	10.6	22.8
42	0.7	23	46.3	9.9	20.1
43	1.1	26.7	42.8	6.7	22.7
44	8.1	15.6	44.9	7.1	24.2
45	0.8	27.9	49	6	16.3
46	5.3	28.2	40.5	8.6	17.5
47	4.2	25.5	46.4	6	17.9
48	6.6	24.8	39.9	9.7	19.0
49	1.3	29	45.5	9.1	15.1
50	5.7	25.9	40.1	10.2	18.1
51	4.4	27.9	39.6	11.1	17.0
52	8.3	10.4	44.2	11.7	25.4
53	3.8	27	39.8	5.2	24.2
54	5.4	23.1	43.8	8.5	19.2
55	5.8	15.2	51.2	6.9	20.8
56	0.7	23.4	54.8	3.6	17.5
57	3.9	19.5	49.9	7.1	19.5
58	4.4	23	46.8	7.1	18.6
59	4.7	23.3	50.1	4.3	17.6
60	3.8	24	49.8	6.3	16.1
61	4.9	14	47.1	9.3	24.6
62	0	23.8	45.6	10	20.6
63	5.5	15	44.2	15.3	20.1
64	5	20.8	45	10.6	18.6
65	5.9	11.7	50.5	8.8	23.0
66	1.2	25.3	47.8	8.3	17.4
67	9.5	20.4	36.8	3.7	29.7
68	0.8	15.8	52.7	13.9	16.7
69	4.7	19.7	44.2	9.9	21.5
70	1.8	9.2	53.1	17.6	18.3
71	3.4	17.5	45	16.4	17.7

72	0	10.8	50.9	34.1	4.1
73	0	24.2	42.7	24.1	9
74	0	23.5	42.8	22.3	11.4
The balance consists of = impurities raw materials, moisture and insoluble S-containing compounds.					

Example 2

A 150 kg, 97% melt is made from ammonium nitrate (AN), chemical composition 15 of example 1, additional dolomite, magnesium nitrate and a few ppm granulation additive at 160°C. This melt is sprayed on seed material in a batch fluid bed granulator at a bed temperature of approximately 130°C. After granulation the product is cooled to 35°C. The desired amount of magnesium sulphate in the end product determines the amount of AN and dolomite which is added. In case of the urea the same holds, only 120 kg of 96% melt is applied at 135°C and granulated at 108°C.

Table 2

	Test 1	**Test 2**
Moisture %	0.46	0.43
SO_3 %	9.93	10.27
MgO % total / water soluble	11.43 / 5.90	11.27 / 5.87
CaO % total / water soluble	10.73 / 2.83	10.8 / 2.94
N %	19,21	19,14
Abrasion (g/kg) / Dust	0.3	0.3
Crushing strength (kg)	9.4	9.3
Density	2.021	2.019
Apparent Caking	free flowing	free flowing

In table 2 the results of two different tests according to the above described procedure are shown. From table 2 it becomes clear that the obtained product is sufficiently stable in composition and characteristics and the process is stable in time and easily be reproduced.

Example 3

In another test in which a fertilizer composition was made in the same way as described is example 2, the use of mineral kieserite and chemical composition no.3 have been compared. The results are shown in table 3.

Table 3

	Mineral	Chemical Comp. No. 3
Moisture %	0.33	0.48
N %	20.1	19.7
SO_3 %	10.25	10.2
MgO % total / water soluble	10.06 / 6.80	10.86 / 5.45
CaO % total / water soluble	0	2.43
Apparent density	1.933	1.997
Abrasion (g/kg)	2.2	0.5
Crushing strength (kg)	7	8.8

From this test it becomes clear that the obtained fertilizer composition has an improved crushing strength and has a better resistance against abrasion.

Example 4

In this example two fertilizer compositions with the chemical composition no.36 are compared. In example 4A 25 % of the chemical composition has been used, and in example 4B 15 %.

Table 4

Synthetic Kieserite no. 36	**4A**	**4B**
Moisture %	0.59	1.00
SO_3 % grav	15.52	9.84
MgO % total / water soluble	10.32 / 6.87	9.20 / 5.97
CaO % total / water soluble	7.63 / 2.55	7.42 / 2.15
N %	19.32	21.6
Abrasion (g/kg) Dust	1.9	0.9
Crusing strength (kg)	8.9	8.9
Apparent density	2.000	1.935
Bag test	free flowing	free flowing

It becomes clear by modifying the amount of chemical composition, the amount of Mg and S can be influenced, thereby adjusting the composition of the fertilizer.

Example 5

In this example two urea products have been made by using synthetic kieserite no. 18 and 22 and the characteristics thereof are compared with urea products using mineral kieserite and the standard urea products.

Table 5

Product : Analysis	**Chemical Composition 18**	**Chemical Composition 22**	**Mineral Kieserite**	**Reference Urea**
Moisture %	0.65	0.52	0.61	0.2
N-total (%)	32.11	31.24	31.42	46.2
pH 10%	9.3	9.1	8.47	9.2
Crushing Strength (kg)	7.1	8.1	4.8	4.1
Apparent density	1.56	1.57	1.41	1.28
Abrasion dust (g/kg)	0.6	0.2	1.1	0.1

Also in this test it has been proven that the crushing strength has been improved, whereas the abrasion has been diminished.

Example 6

In a number of test the chemical composition described above and as made in example 1 was used as a coating for fertilizer already shaped as granules. Therefor the chemical composition was fed to a coating device together with fertilizer granules and some water. It was found to be possible to add other chemical substances to the coating thereby improving the composition of the fertilizer granules.

In two practical tests calcium ammonium nitrate granules (CAN) were coated with the chemical composition no. 36 and no. 22 by supplying the chemical composition together with the CAN-granules to a coating device and supplying sufficient amounts of water, necessary to saturate the anhydrite gypsum to the hydrate form.

The obtained granules had the following characteristics:

Table 6

	Chemical composition no. 36	**Chemical composition no. 22**
Moisture %	1.77	1.40
SO_3 %	8.96	9.36
MgO %	8.55	8.84
N %	22.14	21.40
Abrasion g/kg Dust	1.7	0.9
Crushing strength	4.9	5.4

From these tests it becomes clear that a fertilizer granule was obtained having satisfactory mechanical characteristics to be used in standard circumstances. An important advantage of this type of fertilizer granules was that other chemical substances could easily be mixed with the chemical composition used as the coating.

Example 7

In a small scale coating drum (Electrolux) 300 to 400 grams of urea prills are coated with 2% or 4% zinc oxide. The urea prills are obtained from production (urea 6, HAS). The zinc oxide is of analytical quality (99%, Baker) with a very fine particle size. The product have been tested on abrasion properties (PQR abrasion test (2)), i.e. it was checked which amount of coating comes of via dust formation.

Two tests, both based on 2 and 4% of Zinc Oxide (1.6 and 3.2% Zn) have been performed on UF80 coated prills and non-coated prills. The first test used UF80 free prills from production, before screening. In this case the UF coating was applied on cold prills in a small coating drum before coating with zinc oxide. As reference the non-coated prills were coated with zinc oxide. The second tests used prills from production after screening. The non-coated prills were taken before the UF-coating drum, the coated prills just after. Both products were cooled till room temperature before being coated with zinc oxide.

Table 7 Abrasion of non-screened prills with and without UF coating with 2 or 4% ZnO

Product (abrasion: mg/kg)	**UF-coating: 0.3% pilot scale)**	**no UF-coating**
0% ZnO	948	2.099
2% ZnO	2.147	497
4% ZnO	1.249	1.124

Table 8 Abrasion of screened prills with and without UF-coating with 2 or 4% ZnO

Product (abrasion: mg/kg)	**UF-coating: 0.2% (production)**	**no UF-coating**
0% ZnO	-	550
2% ZnO	650	525
4% ZnO	1.300	800

As can be seen from the results in table 7 the randomness of the product quality of the prills, which had not been screened to a defined particle size distribution, has a strong influence on the dust formation of the end product. However, the application of a zinc oxide coating (with or without "glue") does not significantly change the dust formation.

It is clear from the results in table 8 that a UF-coating is not necessary, having in mind that the dust formation of the prills already can vary between 500 and 1200 mg/kg. It can be concluded that the zinc oxide itself already shows enough adhesion to be prevented from blown off.

CLAIMS:

1. Chemical composition to be used as additive for fertiliser composition, characterized in that it comprises 35 - 60 % by weight of magnesium sulphate, 5 - 35 % by weight of calcium sulphate, 10 - 35 % by weight of a mixture containing magnesium carbonate and calcium carbonate up to 5 % by weight of water, either free or bound as crystal water, and the balance magnesium oxide.

2. Chemical composition according to claim 1, characterized in that it comprises at least 40 % by weight of magnesium sulphate.

3. Chemical composition according to claim 1, characterized in that it comprises at most 55 % by weight of magnesium sulphate.

4. Chemical composition according to claim 1, characterized in that it comprises 35 - 45 % by weight of magnesium sulphate.

5. Chemical composition according to claim 1, characterized in that it comprises 40 - 45 % by weight of magnesium sulphate.

6. Chemical composition according to claim 1, characterized in that it comprises 50 - 60 % by weight of magnesium sulphate.

7. Chemical composition according to claim 1, characterized in that it comprises 50 - 55 % by weight of magnesium sulphate.

8. Chemical composition according to any one of claims 1 to 7, characterized in that it contains at most 30 % by weight of calcium sulphate.

9. Chemical composition according to any one of claims 1 to 7, characterized in that it contains at least 15 % by weight of calcium sulphate.

10. Chemical composition according to any one of claims 1 to 9, characterized in that it contains between 2 and 8 % by weight of magnesium oxide.

11. Chemical composition according to claim 10, characterized in that it contains less than 5 % by weight magnesium oxide.

12. A process for preparing a chemical composition containing 35 - 60 % by weight of magnesium sulphate, 5 - 35 % by weight of calcium sulphate, 10 - 35 % by weight of a mixture containing magnesium carbonate and calcium carbonate and the balance being magnesium oxide, characterized in that magnesium oxides, magnesium carbonate and calcium carbonate are mixed with sulphuric acid in a spouted bed reactor, which is driven with air, and the resulting chemical composition is removed from the spouted bed reactor.

13. A process according to claim 12, characterized in that the magnesium carbonate is dolomite.

14. A process according to claim 12 or 13, characterized in that the magnesium oxide has a defined crystal structure.

15. A process according to any one of claims 12 to 14, characterized in that the air is preheated.

16. A process according to any one of claims 12 to 15, characterized in that the bed temperature is maintained at a temperature between 110 and 200°C.

17. A process according to claim 16, characterized in that the bed temperature is at least 120°C.

18. A process according to claim 16 or 17, characterized in that the bed temperature is at most 180°C.

19. A process according to claim 18, characterized in that the bed temperature is at most 150°C.

20. A process according to any one of claims 12 to 19, characterized in that the average particle size of magnesium oxide and/or magnesium carbonate is 90 % by weight smaller than 100 μm and 40 % by weight smaller than 30 μm, respectively.

21. A process according to any one of claims 12 to 20, characterized in that the reaction time is longer than 8 minutes.

22. A process according to any one of claims 12 to 20, characterized in that the reaction time is longer than 10 minutes.

23. A process according to any one of claims 12 to 22, characterized in that a micro nutrient is mixed with the chemical composition according to any one of claims 1 to 11 in the spouted bed.

24. Fertiliser, characterized in that, prior to or during granulation the fertiliser has been mixed with a chemical composition according to any one of claims 1 to 11.

25. Fertiliser according to claim 24, characterized in that prior to granulation the fertiliser has been mixed with the chemical composition and other chemical substances such as micro-nutrients.

26. Fertiliser granules, characterized in that the granules are coated with a chemical composition according to any one of claims 1 to 11.

27. Fertiliser granules according to claim 26, characterized in that the coating is filled with other chemical compositions selected from the group of primary or secondary nutrients, micro-nutrients, nitrification inhibitors, slow release controlling agents, biostimulants, pesticides, herbicides, fungicides, living organisms, vitamins, amino acids, marine based additives or metal chelates.

28. A process for preparing fertiliser granules, wherein:

a mixture and fertiliser granules are fed to a coating device for coating the granules with one or more compounds from the mixture, and

removing coated fertiliser granules,

characterized in that the mixture comprises:

a chemical composition according to any one of claims 1 to 11,

an amount of water, and optionally

amounts of products selected from the group consisting of secondary nutrients, micro-nutrients, nitrification inhibitors, slow release controlling agents, biostimulants, pesticides, herbicides, fungicides, living organisms, vitamins, amino acids, marine based additives and metal chelates.

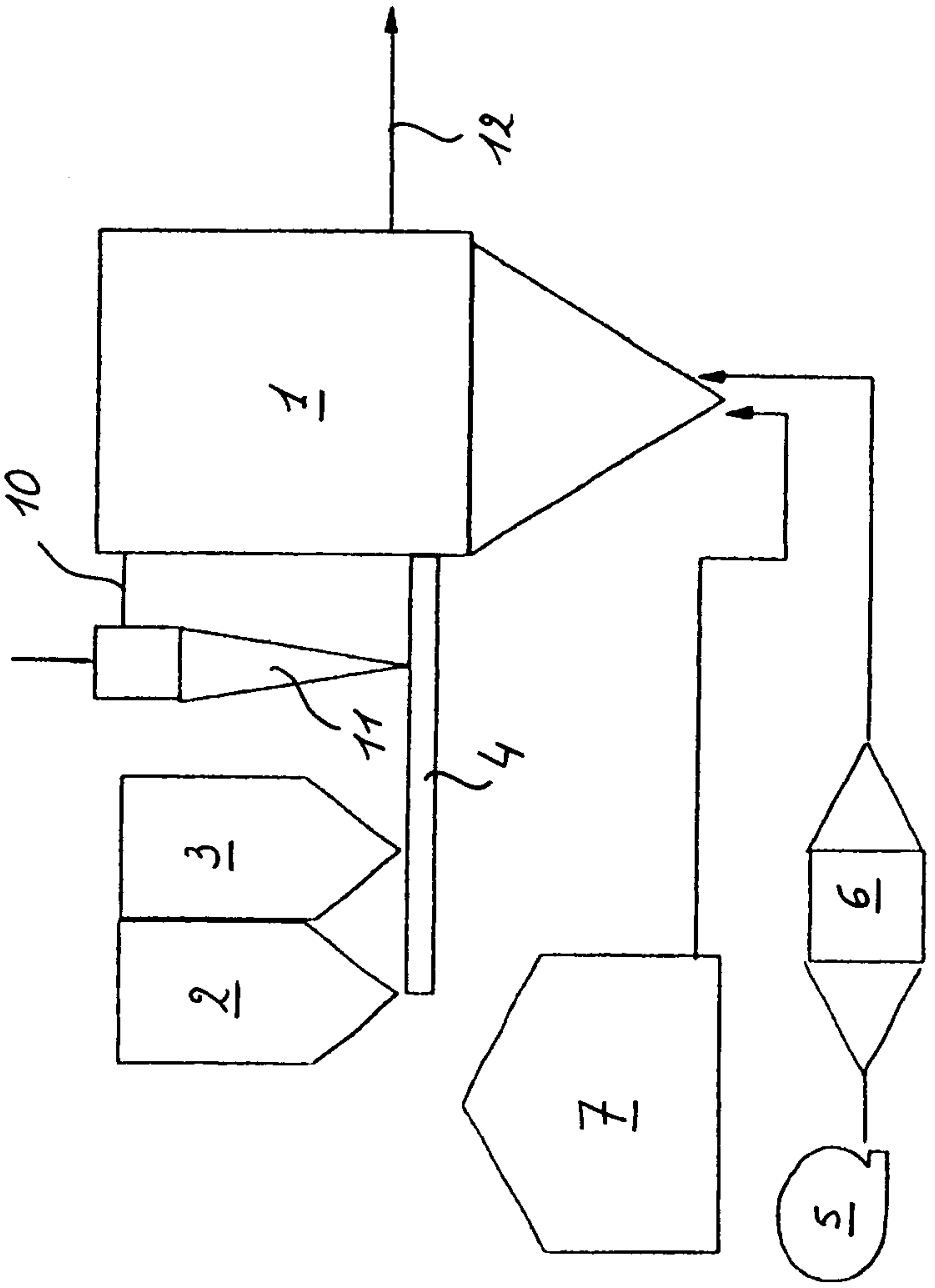
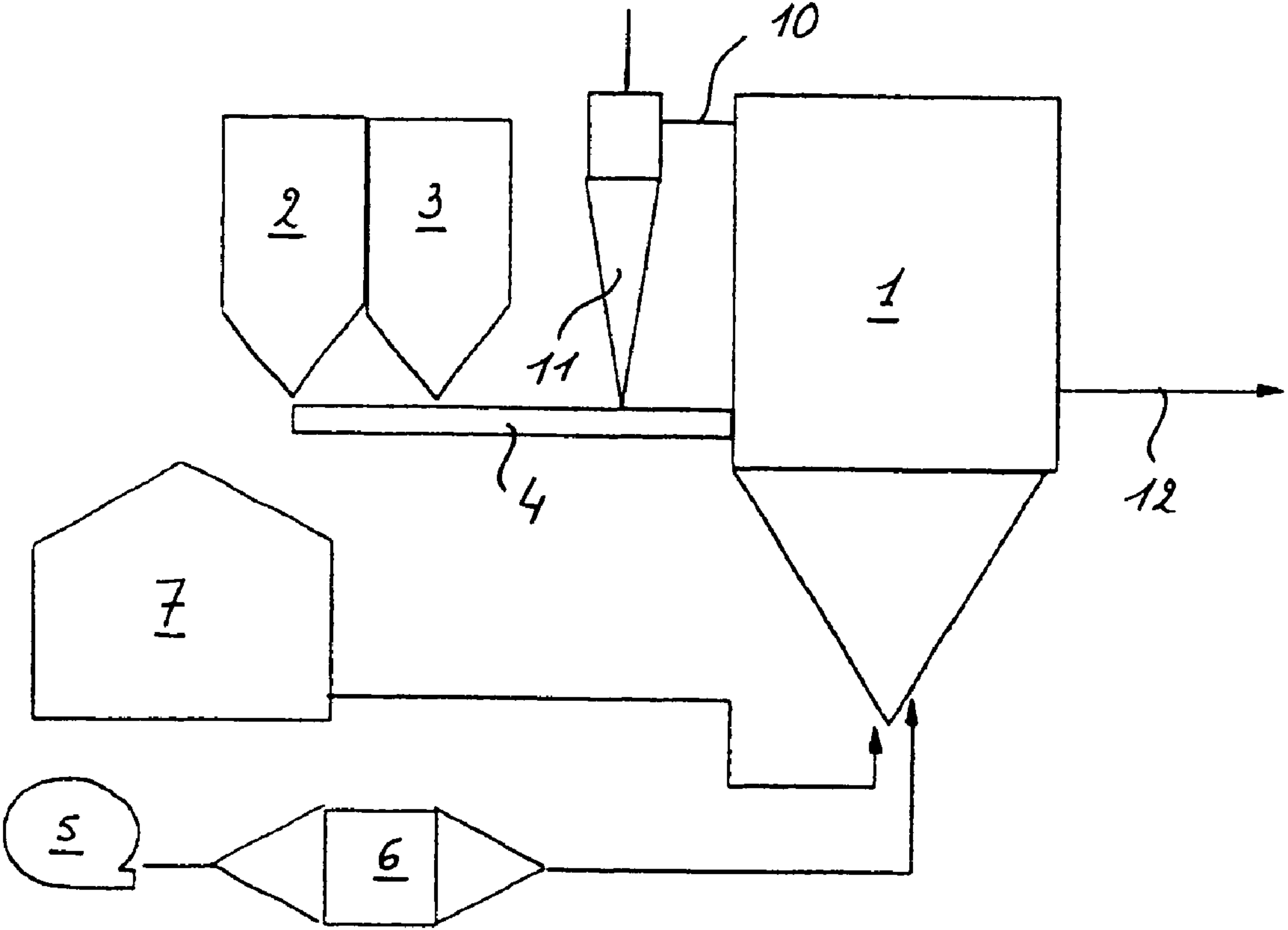


FIG.1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