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- (73) Patenthaver: **LAR Process Analysers AG, Neuköllnische Allee 134, 12057 Berlin, Tyskland**
- (72) Opfinder: **ARTS, Werner, Berchtersgardener Str. 18, 10825 Berlin, Tyskland**
GENTHE, Wolfgang, Gardes-du-Corps-Str. 114, 14059 Berlin, Tyskland
- (74) Fuldmægtig i Danmark: **Patrade A/S, Ceresbyen 75, 8000 Århus C, Danmark**
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Description

The invention relates to an analysis system for analysing water and waste water, comprising an analysis apparatus with an apparatus housing and an injection port for introducing a substance to be analysed into the apparatus, and an injection
5 syringe.

Such analysis arrangements are known per se, for example, from EP 1022564A2, and are also produced and marketed by the Applicant.

10 An object of the invention is to provide an improved analysis system of this type which in particular can provide reliably precise and precisely reproducible analysis results.

This object is achieved according to a first aspect of the invention with an
15 analysis system having the features of claim 1.

The invention first involves the notion of modifying the associated injection syringe, modified from conventional injection syringes, in the interests of an optimum and reproducible implementation of the injection operation. In this
20 instance, an outlet opening of the needle whose surface normal coincides with the longitudinal needle axis is provided. Furthermore, an automatically acting ejection element for ejecting a predetermined quantity of substance in a predetermined injection time period is provided.

25 In the invention, the injection port is connected to a cylindrical reaction vessel for thermal digestion of the substance to be analysed and it has guide means for guiding the injection syringe into a predetermined injection position. Specifically, the guide means are formed in accordance with the shape of the injection needle in such a manner that the longitudinal axis of the inserted injection needle
30 coincides with the longitudinal axis of the reaction vessel. The guide means comprise a cylindrical or conical guide sleeve. Furthermore, the guide means have a stop for limiting the depth of penetration of the injection needle into the reaction vessel.

In another embodiment of the invention, the ejection element is constructed as a lockable pressure spring which acts on the piston of the injection syringe. The pressure spring which may be constructed, for example, as a steel cylinder spring, thus it replaces a manual actuation of the syringe. In contrast to manual actuation, the predetermined spring characteristics of the pressure spring ensure a precisely reproducible sample ejection per unit of time. The implementation of this important action does not, however, necessarily have to be achieved by means of a pressure spring (as a particularly simple and cost-effective embodiment), but instead can also be carried out, for example, by a small linear motor or a hydraulic or pneumatic drive with predetermined ejection characteristics.

Advantages and features of the invention will further be appreciated from the following short description of an embodiment with reference to the Figures, in which:

Figure 1 is a schematic illustration of significant apparatus components of an analysis apparatus according to an embodiment,

Figure 2 is a perspective illustration of that analysis apparatus,

Figure 3 is a schematic longitudinal sectioned illustration of an injection syringe with an injection needle introduced into the injection port according to an exemplary embodiment of the analysis system, and

Figures 4a and 4b are graphs in order to illustrate an aspect of the invention.

Figures 1 and 2 show schematically significant components of an analysis apparatus 1 for determining the COD (chemical oxygen demand) of water or waste water. The basic structure of such apparatuses and the operation thereof are known to the person skilled in the art and are therefore not described here in greater detail, especially since it is not required for the understanding of the present invention.

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The analysis apparatus 1 comprises a thermal reaction vessel or a furnace EB, in which by means of an injection syringe MM via an injection port P which is arranged on the furnace upper side a water sample can be injected and in which

this sample is thermally processed. There is supplied to the furnace via a non-return valve RM1 a carrier gas flow which is composed of air and nitrogen. The carrier gas flow is controlled by means of an air pressure regulator KH1, a nitrogen pressure regulator KH2, an air throughflow regulator KH4 and a nitrogen
5 throughflow regulator KH5 and filtered by means of a first and second fine filter HQ1, HQ2 at the input side of the furnace. At the input side of the furnace, an air pressure display BP1 and a nitrogen pressure display BP2 are also provided.

At the output side of the furnace, the gas flow first reaches a condensate vessel
10 CM1 and the non-condensed portion subsequently passes through a quartz wool filter HQ3 and an acid trap HS1 before it reaches the acid detector B1, which finally outputs a (an electrical) measurement value to an adjustable evaluation device A, in which in particular an integration time for integration of a time-dependent-detected oxygen detection signal is provided, see below for further
15 details.

Figure 2 is a perspective view of the analysis apparatus 1 in a state in which the apparatus housing 1' is partially open and a portion of the apparatus components has been removed from the housing. The apparatus housing is substantially in the
20 form of a square prism and in the apparatus front 1A' there is provided an opening 1B' which is intended to be closed by means of a perforated door 3 which is mounted on the left lateral edge of the apparatus front.

A carriage 5 which is adapted in terms of its dimensions to the opening 1B' and
25 on which the furnace EB, the condensate vessel CM1, the quartz wool filter HQ3 and the acid trap HS1 are arranged, can be pulled so far out of the housing that the components mentioned become freely accessible. In the retracted state of the carriage 5, the apparatus housing 1' is closed with the door 3.

30 At the right side of the apparatus front 1A' is an operation field 1C' on which a plurality of operation and display elements are arranged, including a temperature display/control TC and the adjustment regulator KH1 and KH2 for the air or nitrogen pressure and the associated display elements BP1 and BP1.

Located at the apparatus upper side 1D' is the injection port P whose structure and dimensions are adapted to those of the injection syringe MM shown in Figure 1 and which communicates in the apparatus inner space with a corresponding
5 injection valve EB1 of the furnace EB when the furnace is in the normal position for use thereof inside the apparatus housing.

Figure 3 is a schematic longitudinal section of the basic structure and the mutually adapted geometric configurations of the injection syringe MM and of the
10 injection port P of the furnace EB of the analysis system. The injection port P comprises a guide sleeve P1 which is constructed in a substantially cylindrical manner in the longitudinal extent thereof and whose diameter and length are adapted to the corresponding dimensions of an injection needle MM1 of the injection syringe MM and whose longitudinal axis coincides with a longitudinal
15 axis LA1 of the furnace EB which is constructed to be cylindrical in its basic form. At the upper side of the injection port P there is provided a hole P2 with an increased diameter whose dimensions are adapted to those of a needle hub MM2 of the injection syringe and whose lower end face acts as a stop for depth limitation when the injection syringe is introduced. A precisely predetermined
20 position of the needle end which is cut at right-angles relative to the longitudinal needle axis LA2 of the injection syringe in the furnace EB and consequently a precisely predetermined injection location are ensured with this stop.

In the injection reservoir MM3, there is supported so as to be able to be
25 longitudinally displaced a syringe piston MM4 whose free end is constructed in conventional manner for manually drawing up a sample. At the upper end of the injection reservoir there is embedded therein a pressure spring MM5 whose upper end is supported against the upper end wall of the injection reservoir and whose lower end acts on the end of the syringe piston MM4. After the syringe has been
30 drawn up, using a locking lever MM6 the syringe piston is locked with a tensioned spring MM5. After the locking MM6 has been released, the syringe piston MM4 is pressed downwards by the force of the pressure spring MM5 and the sample contained in the injection reservoir MM3 is injected in a

predetermined time range or with a predetermined ejection speed into the furnace.

This ejection of the predetermined sample quantity at a precisely predetermined speed or in a precisely defined time range is just as important for reproducible
5 analysis results as the precise injection position and direction, which are ensured by the specific configuration of the injection needle and the injection port.

Figures 4a and 4b illustrate the effect of an adjustable integration time of the post-processing device A for processing an oxygen measurement signal which has
10 been recorded in a time-dependent manner. Figure 4a shows in this instance three different curve shapes with (according to the prior art) fixedly adjusted integration time t_i . It can be seen that in this instance only the integration of the measurement signal S_1 illustrated with the solid line leads to a correct result, whilst the adjusted integration time for the measurement signals S_2 and S_3 is
15 clearly too short and significant signal portions are not detected. Remedial action is provided in this instance by the adjustment of a longer integration time $t_{i2,3}$ for the signals S_2 and S_3 , as shown in Figure 4b, which the operator of the analysis system can carry out in accordance with the fixed signal curve shape on the post-processing device A.

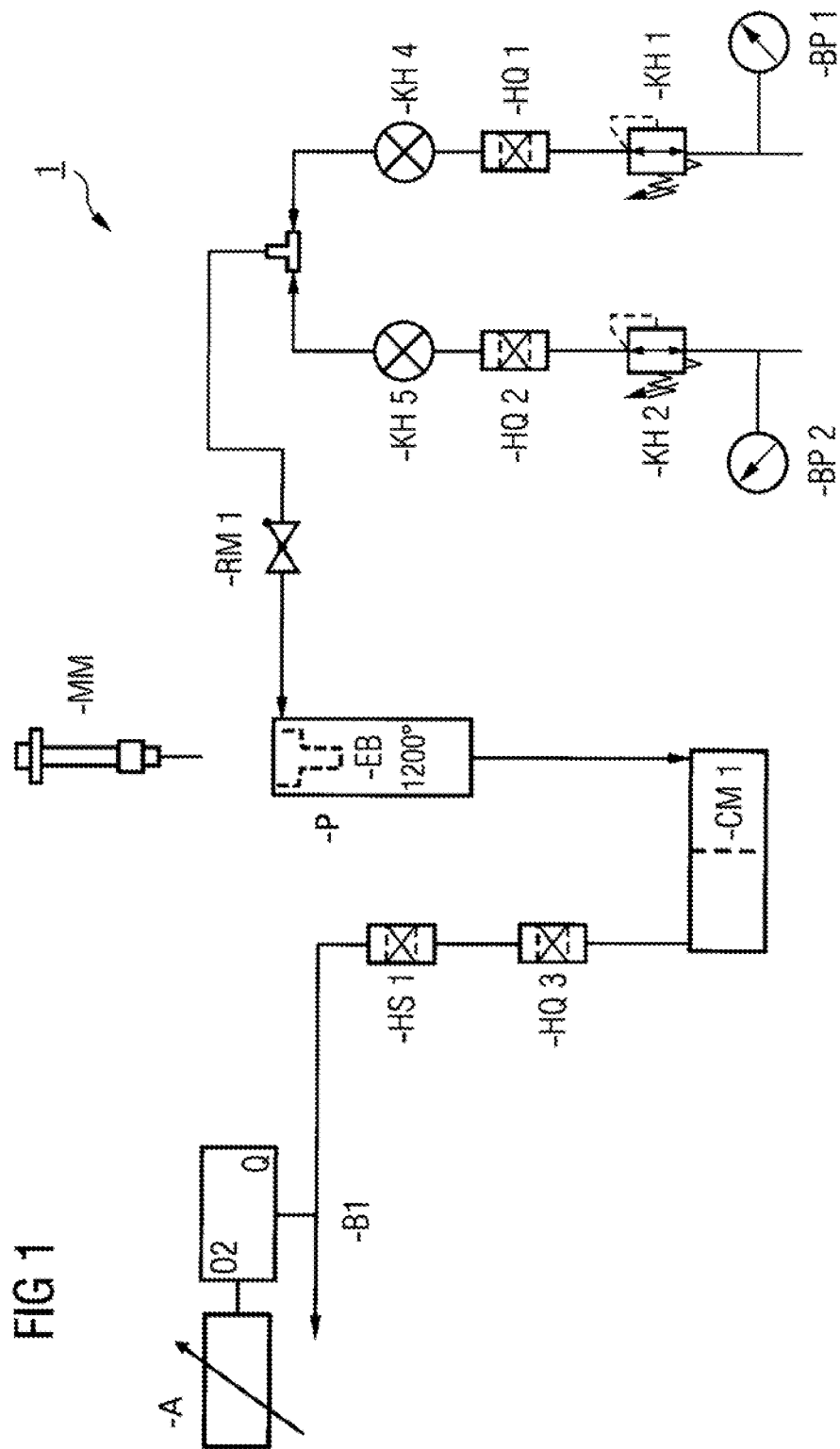
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The implementation of the invention is not limited to this example, but instead is also possible as a large number of modifications which are included within the scope of the claim.

PATENTKRAV

1. Analysesystem til analysering af vand og spildevand, omfattende en analyseanordning med
et apparaturhus, der rummer apparaturkomponenter, og som på en husoverflade har en
5 injektionsåbning udformet som en injektionsåbning til indføring af et stof, der skal analyseres i en apparatkomponent, når apparathuset er lukket, og
en injektionssprøjte, der har en udløbsåbning af injektionsnålen, hvis overfladenormal falder sammen med den langsgående akse, og som har et automatisk virkende udsprøjtningselement til at sprøjte en forudbestemt mængde stof i en forudbestemt injektionsperiode,
10 hvor injektionsåbningen er forbundet til en cylindrisk reaktionsbeholder til termisk nedbrydning af det stof, der skal analyseres, og omfatter styringsmidler til at styre injektionssprøjten til en forudbestemt injektionsposition, hvor styringsmidlerne er dannet i overensstemmelse med formen af injektionsnålen på en sådan måde, at injektionsnålen er i stand til at blive indsat i injektionsåbningen, således at den indførte injektionsnåls længdeakse falder sammen med reaktionsbeholderens længdeakse og omfatter en cylindrisk eller konisk styrebøsning og et stop til begrænsning af indsprøjtningssnåls dybdepenetrering ind i reaktionsbeholderen, hvor en boring med forstørret diameter er tilvejebragt på oversiden af injektionsåbningen, hvis dimensioner er tilpasset til dem i et nålenav i injektionssprøjten, og hvis nedre endeflade fungerer som et stop til begrænsning af dybdepenetreringen af injektionsnålen i reaktionsbeholderen.
15
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FIG



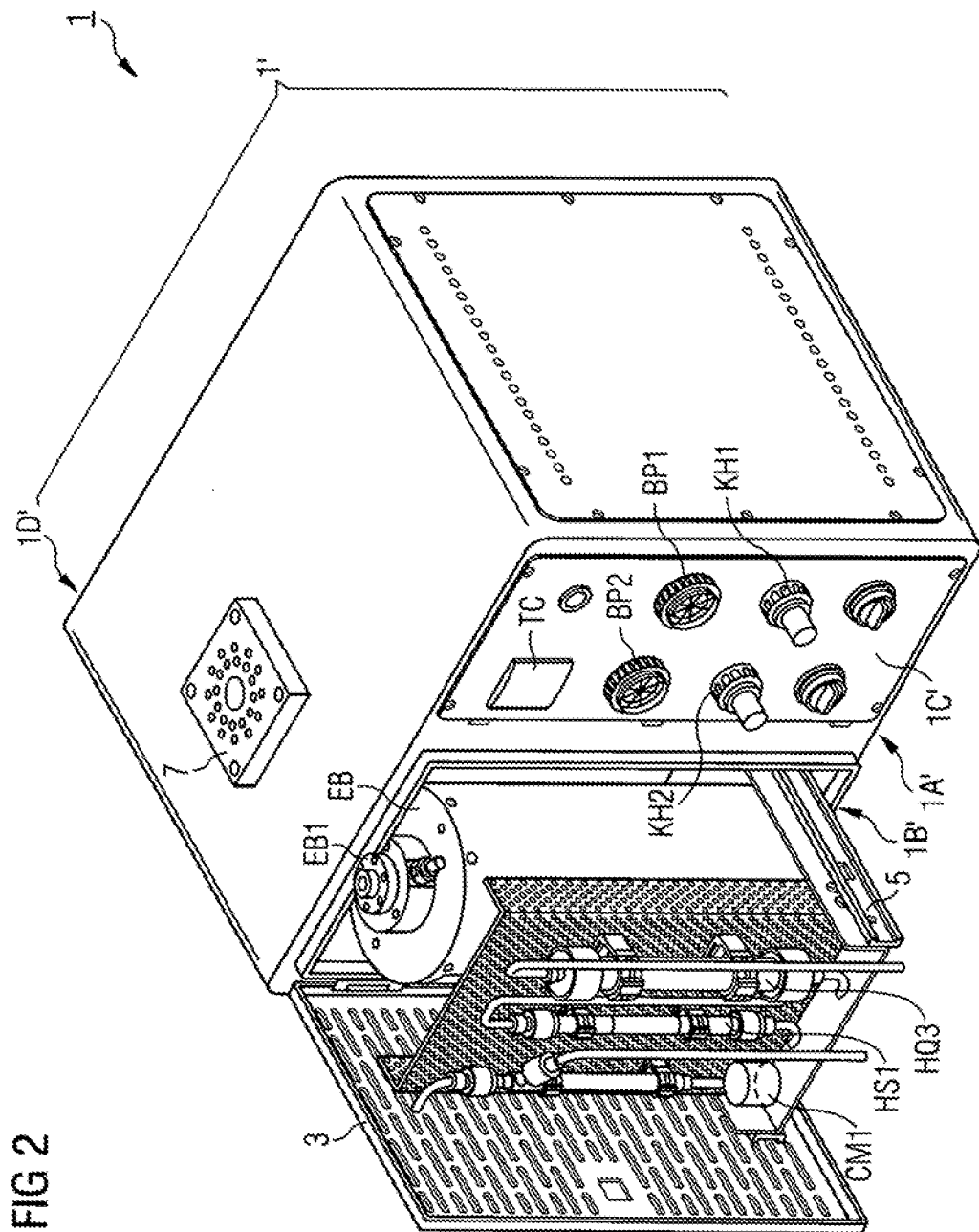


FIG 2

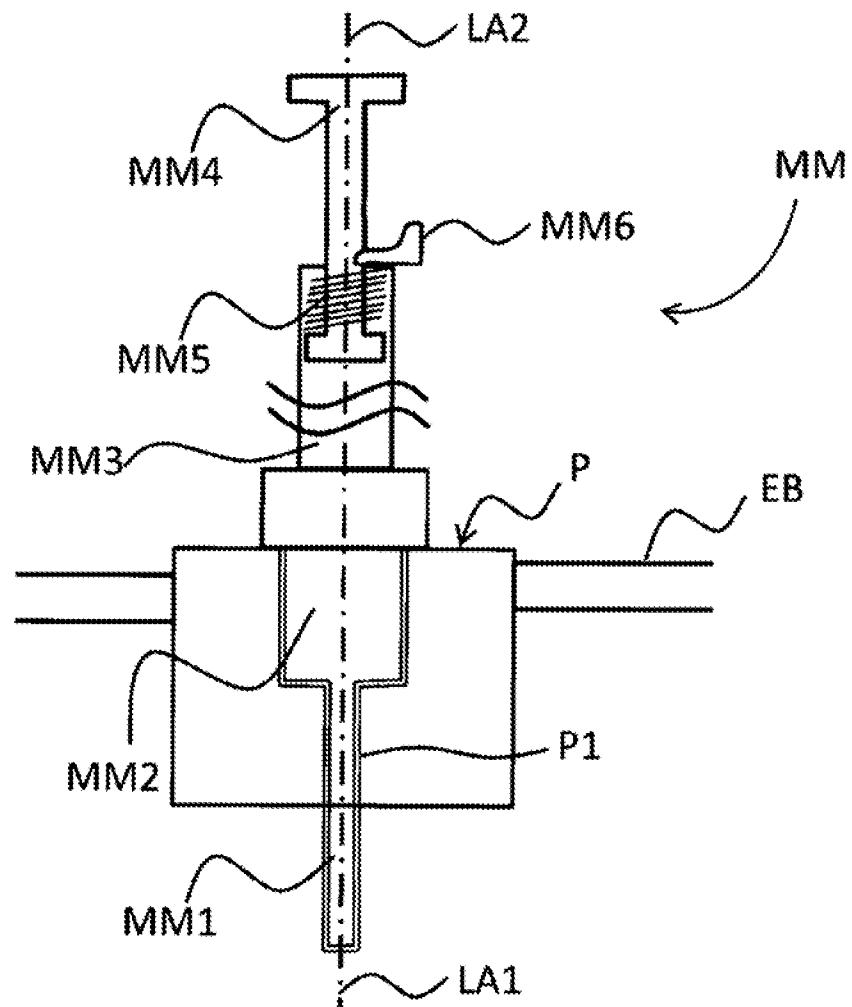


Fig. 3

