in US 2 876 070 and DE 10 2008 040 544 A1 by use of reactors having gas collecting regions in the form of intermediate trays or cups arranged within the sulphur melt. However, this type of construction achieves a conversion of hydrogen of only > 96%. Increasing the number of gas collecting regions could perhaps enhance the conversion, but this would have the disadvantage that a greater reactor volume would be required.

The principle of increasing the residence time of the hydrogen gas in the sulphur melt is also accomplished in DE 10 2008 040 544 A1 by a reactor having a bed of random ceramic packings in the sulphur melt. This reactor achieves a conversion of > 99%. However, this reactor design requires constant hydrogen supply, since, in the event of a decline or shutdown in the hydrogen supply, the reaction gas can escape completely from the region of the random packing bed, and the random packing bed can become filled with liquid sulphur. Such a reactor can therefore be operated only within a very narrow load range.

A further means of enhancing the reaction rate is the use of catalysts, for example oxides or sulphides of cobalt, nickel or molybdenum. This approach is disclosed, for example, in US 2 863 725 and EP 2 125 612 B1 in the form of reactors having catalyst-filled tubes which dip into the sulphur melt, and the gaseous reactants flow through them. However, disadvantages of these reactors are found to be that they are operated at a pressure of < 5 bar, and that, as a result of the fact that the reaction of sulphur and hydrogen is predominantly catalytic, a large amount of catalyst is required.

In a first aspect of the present disclosure, there is provided a reactor suitable for continuous preparation of hydrogen sulphide by exothermic reaction of sulphur and hydrogen to form a final product gas mixture P_{final} comprising hydrogen sulphide and sulphur at elevated temperature and elevated pressure relative to standard conditions, said reactor comprising

- a lower reactor region suitable for accommodating a sulphur melt,
- one or more non-pressure-bearing first cavern(s) and at least one supply device suitable for controlled supply of pressurized gaseous hydrogen per first cavern, said caverns being suitable for at least

temporary accommodation of a product gas mixture P_1 which forms in exothermic reaction and comprises hydrogen sulphide, sulphur and hydrogen, and

- a gas collecting region suitable for accommodating the product gas mixture P_{final} at elevated temperature and elevated pressure relative to standard conditions,

characterized in that the reactor additionally comprises one or more non-pressure-bearing installed device(s) suitable for continuous transfer of the total amount of product gas mixture P_u formed in the lower reactor region to the gas collecting region, wherein said one or more installed devices contain a heterogeneous catalyst for further conversion of hydrogen and sulphur present in the product gas P_u to hydrogen sulphide.

In a second aspect of the present disclosure, there is provided a process for preparing hydrogen sulphide by exothermic reaction of sulphur with hydrogen at elevated temperature and elevated pressure relative to standard conditions to form a product gas mixture P_{final} comprising hydrogen sulphide and sulphur, said process comprising the following steps:

- providing a sulphur melt in a lower reactor region of a pressurized reactor,
- supplying pressurized hydrogen into the sulphur melt, the hydrogen supplied being accommodated at least partly, together with sulphur converted from the sulphur melt to the gaseous state, by at least one non-pressure-bearing first cavern,
- at least temporarily leaving the hydrogen and the sulphur in the first cavern(s), so as to form, in exothermic reaction, a product gas mixture P_1 comprising hydrogen sulphide, sulphur and hydrogen, and
- continuously transferring the total amount of the product gas mixture P_u formed in the lower reactor region to a gas collecting region by means of one or more non-pressure-bearing installed device(s), wherein by use of a catalyst in the installed device(s) the sulphur and hydrogen present in the product gas mixture P_u are reacted to form further hydrogen sulphide.

In a third aspect of the present disclosure, there is provided a use of a reactor according to the first aspect for preparation of hydrogen sulphide having a sulphane content not exceeding 600 ppm.

It is therefore an object of the present invention to provide a reactor for preparation of hydrogen sulphide from sulphur and hydrogen, which ensures a hydrogen conversion of > 99% and a high purity of the hydrogen sulphide produced. The reactor should also enable the preparation of hydrogen sulphide at a pressure of > 5 bar, have a very compact design and ensure a very wide load range. Especially in an integrated production system, a very wide load range is advantageous, in order to be able to react flexibly to variations in load, rather than having to dispose of excess amounts which are not required by the integrated system at that moment but result from inflexibility. Finally, the reactor, from the