

REPLACED SHEETS SG

- ☒ Description : paged/ to paged 6
☒ Claim(s) : pagedZ. to paged 8
☒ Drawing(s) : paged/ to paged 2
☒ Abstract : paged/ to paged

- 1 -

0587532

MG/et

This Sheet Has Been Replaced



Heinrich Kuhn AG

8486 Rikon

Safety valve for a pressure-cooker

- 5 The invention relates to a safety valve for a pressure-cooker, having a pressure pin which is mounted in a manner which allows it to be displaced axially in a valve housing and is subject to the action of a valve spring.
- 10 In the case of the generic safety valve disclosed by CH-A-631 063, the axial displacement of the pressure pin in the valve housing is essentially proportional to the pressure in the pressure-cooker. The pressure pin is connected to the interior of the pressure-cooker and in
- 15 the event of excess pressure is displaced, starting from a zero position, counter to the recoiling force of the valve spring. CH-A-411 272 discloses a similar safety valve which is provided with an acoustic or optical signalling device to indicate the pressure in the
- 20 pressure-cooker.

- The purpose of the invention is to provide a safety valve of this generic type which permits an indication of pressure by virtue of an electrical signal, and which, moreover, operates in a functionally reliable
- 25 and precise manner and nevertheless is of structurally simple and sturdy design. The intention is for the valve to be able to measure essentially every pressure between zero and an upper limiting pressure.

- The object is achieved using a safety valve of
- 30 the generic type by virtue of the fact that a magnetic position sensor and means are provided, and these means generate a magnetic field which acts on the magnetic position sensor and the magnetic flux density of which changes linearly at the location of the magnetic position



- 2 -

sensor as the pressure pin is displaced. An essential advantage of the valve according to the invention consists in the measurement being contactless. As a result, the valve can be configured in such a manner that the measuring device does not make it more difficult to clean and the safety functions are met. An advantage of a safety valve of this type is also to be seen in the fact that such a valve, in comparison with a customary valve of this generic type, does not necessitate a change in mechanical function and only a slight change in the basic mechanical design.

According to a development of the invention there is inserted into the shank of the pressure pin a bar magnet which forms the abovementioned means for generating the magnetic field which acts on the position sensor. This pressure pin can be of exactly the same external design as a pressure pin which is known per se. A highly corrodible bar magnet can be accommodated in a mechanically and chemically protected manner in the pressure pin.

According to a further design variant the pressure pin has a conical ferromagnet which is arranged in an air gap in a magnetic system. In this case, the position sensor is likewise arranged in such a manner in an air gap in the magnetic system that the magnetic field which is detected by the position sensor during displacement of the pressure pin varies with the change in the average magnetic permeability of the air gap. The magnetic field which is detected by the position sensor thus varies with the change in the average magnetic permeability of the air gap which essentially consists here of the pressure pin. The measurement of pressure with this safety valve is particularly dimensionally tolerant, linear and, in addition, stable.

If, according to a development of the invention, an analog Hall sensor is provided as position sensor it is possible, using the latter in pulse-controlled operation, to sense the position of the pressure pin magnetically, thus permitting a measurement with particularly



low battery consumption. Even the use of a button cell allows a long period of measurement in this case.

Further advantageous features emerge from the dependent claims and from the description which follows.

5 Two exemplary embodiments of the invention are explained in more detail below with reference to the drawings, in which:

10 Figs. 1 to 3 show a longitudinal section of a safety valve according to the invention, different pressures being assumed in each case in the pressure-cooker,

Fig. 4 shows a longitudinal section of a safety valve according to one variant,

15 Fig. 5 shows a section along the line V-V in Fig. 4, and Fig. 6 shows, in arbitrary units, the profile of the voltage which can be picked off at the Hall sensor in relation to the pressure in the pressure-cooker.

The safety valve according to Fig. 1 has an
20 essentially cylindrical valve housing 3 which is fastened on a pressure-cooker lid 6 by means of a nut 7 which is screwed onto an external thread 22 of the valve housing 3. A pressure pin 2 is mounted in a manner which allows it to be displaced axially in a hole 14 in the
25 valve housing. At the upper end the pressure pin 2 protrudes beyond the valve housing 3 and is provided here in a known manner with a screwed-on cap nut 1. At its other end the pressure pin 2 has a valve piston 20 which cooperates with a valve seat 8 of the hole 14 and which
30 has a step 12 in order to support a valve spring 5 which is likewise known per se. An upper inner shoulder 13 forms an opposite support for the valve spring 5. The compression spring [sic] 5 is situated in an interior space 9 in the valve housing 3, which space is connected
35 to the outside air via a blow-off opening 10. A further hole 11 serves to relieve compressed air in the interior space 9. The description of the safety valve design given up to now corresponds to that of valves which are already known.



At the upper end the valve housing 3 has a region 16 which has a central hole 24 for passage of the pressure pin 2. In the upper region 16 of the housing 3 there are arranged a magnetic semiconductor position sensor, constructed here as a Hall sensor 23, and a battery 40. The Hall sensor 23 is connected to the battery 40 via connections 17 and 18 for the supply of direct current. The battery may, for example, be accommodated in a lid handle or in the valve housing 3. If the Hall sensor 23 is arranged in the pressure pin 2 the battery 40 may also be accommodated in the cap nut 1. To pick off a voltage the Hall sensor is provided in a known manner with an electrode 19. The Hall sensor 23 is arranged in the vicinity of the hole 24, for example, accommodated in a corresponding recess in the housing 3. The Hall sensor 23 and the connections as well as the Hall electrode may, however, also be cast into a cap.

The magnetic field of a bar magnet 15, which is arranged in the upper part of a shank 25 of the pressure pin 22, acts on the Hall sensor 23. This permanent magnet 15 is polarized in its direction of movement or longitudinal direction. The magnetic field issuing from the bar magnet changes, at the location of the Hall sensor, in the range used essentially linearly as a function of the displacement of the pressure pin 2 in the valve housing 3. The displacement of the pressure pin 2 is opposed by the force of the valve spring 5, this force being proportional to the pressure in the pressure-cooker.

Fig. 1 shows the valve in a position in which the valve piston 20 seals the pressure-cooker off from the outside and thus makes it possible for a pressure to build up therein. The Hall sensor 23 is situated in the vicinity of one pole of the bar magnet 15 and a maximum voltage can be picked off at this.

If the pressure in the pressure-cooker rises the pressure pin 2 moves upwards, for example into the position shown in Fig. 2, counter to the recoiling force of the valve spring 5. The Hall sensor 23 is removed from



the zero position, designated here by A, corresponding to the displacement of the pressure pin 2 and is exposed to a magnetic field of lower flux density. The voltage which can be picked off at the Hall electrode 19 is correspondingly lower, for example 0. The pressure in the pressure-cooker is, for example, 0.8 bar here.

If the pressure increases further to reach a very great excess pressure the pressure pin 2 moves into the position, shown in Fig. 3, in which the blow-off opening 10 connects the interior space of the pressure-cooker to the outside air. The excess pressure in the pressure-cooker can hence be reduced by way of the blow-off opening 10. In this case, the bar magnet 15 is in a position in which it acts with maximum magnetic flux density on the Hall sensor 23. The amount of voltage which can be picked off at the Hall sensor is correspondingly likewise at a maximum.

It is then essential for the voltage, which can be picked off at the Hall sensor 23, largely in a used measuring range M to be linear with respect to the pressure prevailing in the pressure-cooker. This is shown by Figure 6 in which the profile of the voltage U which can be picked off at the Hall sensor 23 is shown as a function of the pressure P in the pressure-cooker. The point P1 corresponds to the position of the pressure pin 2 in the starting position according to Fig. 1, the point P2 to the central position according to Fig. 2 and, finally, the point P3 to the position of the pressure pin 2 in the case of a great excess pressure in the pressure-cooker. The voltage which can be picked off at the Hall sensor 23 is hence a direct measure of the pressure prevailing in the pressure-cooker.

Figs. 4 and 5 show a design variant of a safety valve according to the invention. This has a valve housing 3 on top of which an annular cap 37 is fitted. In this two iron armatures 36 and 39 are arranged mirror-symmetrically fixed laterally next to a hole 38. Permanent magnets 33 are likewise symmetrically arranged between the armatures 36 and 39. The pressure pin 30 is



arranged relative to the Hall sensor 32 in the air gap between the two mirror-symmetrical armatures 36 and 39 and has, in its shank, a conical ferromagnet 31. The latter is inserted in a correspondingly conical, upwardly open recess 34 in the shank 35. As can be seen, the ferromagnet 31 extends in the longitudinal direction of the shank 35. If the pressure pin 30 moves upwards with increasing pressure in the pressure-cooker the average magnetic permeability of the air gap correspondingly continuously changes and, corresponding to this, the magnetic field which the Hall sensor 32 detects. The Hall sensor 32 is, in this case, preferably an analog Hall sensor. Even using this valve a voltage, which is linear with respect to the pressure in the pressure-cooker, can be picked off at the Hall sensor 32. Moreover, the measurement is sufficiently accurate and, moreover, stable despite the comparatively large tolerances which are customary with a valve of this type. The symmetrical design of the magnetic system has the advantage that the pressure pin 30 is not attracted laterally on one side with its displaceability thereby being adversely affected. The sum of the air-gap regions situated on both sides of the pressure pin 30 is constant and is not influenced by the play of the pressure pin in the valve housing 3. An insufficiently linear characteristic line of the position sensor or Hall sensor 32 can be corrected by means of a corresponding contour of the ferromagnet 31.

A design which is not shown here is conceivable in which the position sensor is accommodated in the pressure pin and a magnet in the valve housing. In this case, it would be possible for a battery designed as a button cell to be accommodated in the cap nut of the pressure pin.

A design is also possible in which the battery is replaced by a solar cell. The signal of the position sensor can, for example, be used as a control signal for controlling any controlled variables.



Patent claims

1. Safety valve for a pressure-cooker, having a pressure pin (2, 30) which is mounted in a manner which allows it to be displaced axially in a valve housing (3) and is subject to the action of a valve spring (5), characterized in that a magnetic position sensor (23, 32) and means (15, 31) are provided, and these means generate a magnetic field which acts on the magnetic position sensor (23, 32) and the magnetic flux density of which changes at the location of the magnetic position sensor (23, 32) as the pressure pin (2, 30) is displaced.
2. Safety valve according to Claim 1, characterized in that the position sensor (23, 32) and at least parts of the abovementioned means (15, 31) are assigned to the pressure pin (2, 30) or the valve housing (3), respectively, and as the pressure pin (2, 30) is displaced are moved relative to one another.
3. Safety valve according to Claim 1 or 2, characterized in that the position sensor (23, 32) and/or at least parts of the abovementioned means (15, 31) are assigned releasably to the pressure pin (2, 30) or to the valve housing (3), respectively.
4. Safety valve according to one of Claim 1 to 3, characterized in that the pressure pin (2) has, at least in the upper region, a bar magnet (15) which is polarized in the direction of movement of the pressure pin (2) and which forms the abovementioned means.
5. Safety valve according to Claim 4, characterized in that the bar magnet (15) forms at least part of the shank of the pressure pin (2).
6. Safety valve according to one of Claims 1 to 5, characterized in that the magnetic position sensor (23, 32) is a semiconductor position sensor.
7. Safety valve according to one of Claims 1 to 6, characterized in that the magnetic position sensor (23, 32) is a Hall sensor.
8. Safety valve according to one of Claims 4 to 7, characterized in that the bar magnet (15) is sheathed or



coated as a means of protecting against corrosion and as mechanical protection.

5 9. Safety valve according to one of Claims 1 to 8, characterized in that the position sensor (23, 32) is an analog position sensor.

10 10. Safety valve according to one of Claims 1 to 9, characterized in that the pressure pin (30) has a conical ferromagnet (31) which is arranged in an air gap in a symmetrical magnetic system (36, 39), and in that the magnetic position sensor (32) is arranged in such a manner in this air gap that the magnetic field which it (32) detects during displacement of the pressure pin (30) varies with the change in the average magnetic permeability of the air gap in which the ferromagnet (31) is
15 arranged.

11. Safety valve according to one of Claims 1 to 10, characterized in that the position sensor can be operated with pulse control.

20 12. Safety valve according to one of Claims 1 to 11, characterized in that the magnetic flux density changes linearly at the location of the magnetic position sensor as the pressure pin is displaced.

This Sheet Has Been Replaced

