By adjusting a set screw, a stop position for the metering element is changed as required, which in turn changes the amount of liquid metered by the metering device. However, this means that the operator must manually set the required emptying volume directly on the machine. In DE 31 15 875 C1, a deformable diaphragm is used as the metering element.

A variant of this metering device is described in DE 10 2005 049 941 A1. Here, a metering piston guided in a cylinder as a housing is used as the metering element. The stroke of the metering piston is limited by a threaded rod, which forms the stop for the metering piston. The position of the stop can be adjusted by an electric motor so that the volume of the opening fluid can be set via an electronic control system or, optionally, adjusted automatically.

Metering devices according to the prior art have proven themselves well in practice, but these solutions require mechanical actuators for metering to move to the desired position of the piston with the threaded spindle. This can be a hindrance in the case of high dynamic requirements for the regulating processes for solids discharge.

It is the object of the ~~invention~~ disclosure to solve this problem.

The ~~invention~~ disclosure achieves this object by the subject matter ~~of claim 1~~as defined herein. It further provides the method ~~of claim 9~~herein.

A self-emptying separator is provided ~~according to claim 1~~herein, which comprises a rotatable centrifugal drum that has a vertical axis of rotation and is provided with solids discharge openings, to which an emptying mechanism having a piston valve is assigned, which piston valve can be moved into an opening position and into a closing position in a fluid-actuated manner, in particular by means of a liquid, wherein the emptying mechanism further comprises a control assembly which is assigned to the piston valve for controlling its opening and closing movements, which is provided with a control device and with a metering device for metering and dispensing the amount of fluid, in particular the amount of liquid, required for the opening process, wherein the metering device has a metering element which is displaceable in a metering chamber and which subdivides the metering chamber into a fluid chamber and into a pressure chamber for the application of compressed air, and wherein the metering device has an adjusting system for metering the amount of fluid, in particular the amount of liquid, required for the opening process in the fluid chamber, which adjusting system has a measuring device.

In one aspect, the disclosure relates to a self-emptying separator comprising a rotatable centrifugal drum that has a vertical axis of rotation and is provided with solids discharge openings, to which an emptying mechanism having a piston valve is assigned, which piston valve can be moved into an opening position and into a closing position in a fluid-actuated manner, in particular by means of fluid, wherein the emptying mechanism further comprises a control assembly which is assigned to the piston valve for controlling its opening and closing movements, which is provided with a control unit and with a metering device for metering and dispensing the quantity of fluid, in particular the amount of liquid, required for the opening process, wherein the metering device has a metering element which is displaceable in a metering chamber and which subdivides the metering chamber into a fluid chamber and a pressure chamber for the application of compressed air, wherein the metering device has an adjusting system for metering the amount of fluid, in particular the amount of liquid, required for the opening process in the fluid chamber, which adjusting system has a measuring device, wherein the measuring device is based on a fluidic measuring principle and wherein the adjusting system with the measuring device, which is based on a fluidic measuring principle, has a pressure measuring device which is arranged in the pressure chamber and with which the pressure in the pressure chamber can be determined, wherein the pressure in the pressure chamber forms a basis for the metering of the amount of fluid required for the opening process.

According to the ~~invention~~disclosure, which is particularly easy to implement and yet works precisely, it is further provided that the measuring device is based on a fluidic measuring principle. Preferably, no mechanical actuators, such as a threaded spindle, are required to adjust the opening fluid volume. Thus, the metering device can advantageously meet even very high dynamic requirements of the regulating processes for solids discharge.

According to the ~~invention~~disclosure, it is further provided that the adjusting system with the measuring device, which is based on a fluidic measuring principle, has a pressure measuring device arranged in the pressure chamber, with which the pressure in the pressure chamber can be determined, wherein the pressure in the pressure chamber is or forms a basis of or for metering the amount of fluid required for the opening process. In this way, the feature of the contactless measuring principle is implemented in a particularly advantageous and constructively simple manner.

The fluid used for the opening process is a liquid, preferably it is water or another liquid can be used, such a flowable product to be processed in the separator or a phase of

this product.

In a preferred ~~embodiment~~ example ~~variant~~ of the ~~invention~~disclosure, the control assembly has an injection chamber for opening fluid and an injection chamber for closing fluid, to which the fluid, in particular water, can be supplied for activating the opening and closing movements via an opening fluid supply and a closing fluid supply, respectively, in which an opening fluid valve and a closing fluid valve are arranged, wherein preferably the metering device is assigned to the opening fluid supply. This creates a device with which a defined quantity of solids (phase) can be emptied from a separator quickly and safely as well as precisely.

It is preferably provided in this context that the metering device has a metering element that is movable in a metering chamber and subdivides the metering chamber into a fluid chamber and a pressure chamber to which compressed air is applied. This advantageously creates a structurally simple metering device.

In particular, it can be advantageously provided that the metering element is a piston. This creates a robust and precisely usable metering element. However, the metering element can also have an inherently deformable diaphragm.

It can be optionally provided that the pressure chamber has a temperature sensor. In this way, temperature fluctuations in the pressure chamber of the metering device can

be compensated simply by design, in that the control system varies or adjusts the pressure setpoint accordingly when filling the fluid chamber.

According to a further variant of the ~~invention~~disclosure, it can be provided that the pressure chamber under the metering element is designed to be gas-tight. This advantageously minimizes adverse influences such as pressure fluctuations or inaccurate measurements of the pressure measuring device and thus inaccurate metering of the opening fluid.

It is also advantageous if, according to a further option, the volume of the pressure chamber is dimensioned so that even when the fluid chamber is filled to the maximum, the pressure in the opening fluid supply is still higher than a counterpressure in the pressure chamber. This results in safe operation of the metering device as a result of a simple design measure.

Furthermore, it is advantageous if, according to one option, an orifice plate is installed in the opening fluid supply. This limits the inflow quantity of the opening fluid so that the filling process can be slowed down even at high fluid pressures so that the target position of the metering element can be approached safely.

In a further advantageous ~~embodiment~~ example ~~variant~~ of the ~~invention~~disclosure, the orifice plate is arranged directly upstream of the filling valve. This makes it easy to integrate the orifice plate into the opening fluid supply. For example, it can be integrated in a screw connection between the pipeline and the valve.

The ~~invention~~ disclosure also provides the method ~~according to claim 9~~herein. This advantageous and simple method for performing a solids discharge in a processing of a flowable product with a separator ~~according to any of the preceding claims~~as defined herein, is characterized by the method steps of:

a) providing a self-emptying separator ~~according to one or more of the claims~~as defined herein related thereto and processing a flowable product to be processed, separating it into at least a liquid phase and a solid phase;
b) opening of a filling valve, causing the metering element to move towards the pressure chamber due to the incoming fluid, wherein the pressure in the pressure chamber increases;
c) carrying out a measurement or repeated measurements in or on the pressure chamber with a measuring device and comparing the measurement result with a preset value manually or with a control unit; wherein in step c) the pressure in the pressure chamber is measured with a pressure measuring

device and the measured pressure is compared with a predetermined pressure as default value manually or with a control device;

d) closing the filling valve when the measured value corresponds to the default value; so that a metered opening fluid volume is present in the fluid chamber, wherein in step d) a closing of the filling valve takes place when the measured pressure corresponds to the predetermined pressure, so that a metered opening fluid volume is present in the fluid chamber, and

e) opening the opening fluid valve and the valve of a compressed air line to inject the metered opening fluid volume in the fluid chamber into the separator via an opening fluid supply and an injection chamber for opening fluid and thereby moving a piston valve from a closed position to an open position so that the solids discharge openings are released and the solids phase is discharged from the centrifugal drum.

In another aspect, the disclosure relates to a method for performing a solids discharge in a processing of a flowable product with a separator as defined herein, characterized by the method steps of:

a. providing a self-emptying separator as defined herein and processing a flowable product to be processed, separating it at least into a liquid phase and a solid phase;
b. opening of a filling valve, causing the metering element to move towards of the pressure chamber due to the incoming fluid, wherein the pressure in the pressure chamber increases;
c. carrying out a measurement or repeated measurements in or on the pressure chamber with a measuring device and comparing the measurement result with a preset value manually or with a control unit, wherein in step c) the pressure (P) in the pressure chamber is measured with a pressure measuring device and the measured pressure is compared with a predetermined pressure as default value manually or with a control device;
d. closing the filling valve when the measured value corresponds to the default value; so that a metered opening fluid volume is present in the fluid chamber, wherein in step d) a closing of the filling valve takes place when the measured pressure corresponds to the predetermined pressure; so that the metered opening fluid volume is present in the fluid chamber;
e. opening the opening fluid valve and the valve of a compressed

air line to inject the metered opening fluid volume in the fluid chamber into the separator via an opening fluid supply and an injection chamber for opening fluid, to open the piston valve and to thereby move a piston valve from a closed position to an open position so that the solids discharge openings are released and the solids phase is discharged from the centrifugal drum.

This simple and precise method offers at least the advantages which are also given with regard to device ~~claim 1~~as defined herein and also leads to a precise adjustability of the metering volume.

Further advantageous designs of the ~~invention~~ disclosure can be found in the remaining ~~subclaims~~ parts as defined herein.

The ~~invention~~ disclosure is described in more detail below by means of exemplary embodiments with reference to the drawing. The disclosure ~~invention~~ is not limited to these exemplary embodiments, but can also be realized in other ways according to the wording or in other equivalent ways, wherein:

Fig. 1: shows a partial section of a centrifugal drum in cross-section and a block diagram of an emptying mechanism of the centrifugal drum for a solid phase;

Fig. 2: shows a sectional view of a metering device according to the invention and a block diagram of the metering device, wherein the metering device is shown in a first position;

Fig. 3: shows a sectional view of the metering device and a block diagram of the metering device, with the metering device shown in a second position.

In the following description of figures, an exemplary embodiment is described. The individual features of this exemplary embodiment can also be combined with exemplary

CLAIMS

1. Self-emptying separator comprising a rotatable centrifugal drum ~~(1)~~ that has a vertical axis of rotation and is provided with solids discharge openings ~~(7)~~, to which an emptying mechanism having a piston valve ~~(6)~~ is assigned, which piston valve can be moved into an opening position and into a closing position in a fluid-actuated manner, in particular by means of fluid, wherein the emptying mechanism further comprises a control assembly ~~(28)~~ which is assigned to the piston valve ~~(6)~~ for controlling its opening and closing movements, which is provided with a control unit ~~(24)~~ and with a metering device ~~(14)~~ for metering and dispensing the quantity of fluid, in particular the amount of liquid, required for the opening process, wherein the metering device ~~(14)~~ has a metering element ~~(17)~~ which is displaceable in a metering chamber ~~(16)~~ and which subdivides the metering chamber ~~(16)~~ into a fluid chamber ~~(18)~~ and a pressure chamber ~~(19)~~ for the application of compressed air, wherein the metering device ~~(14)~~ has an adjusting system for metering the amount of fluid, in particular the amount of liquid, required for the opening process in the fluid chamber ~~(18)~~, which adjusting system has a measuring device ~~(15)~~, wherein the measuring device is based on a fluidic measuring principle and wherein the adjusting system with the measuring device, which is based on a fluidic measuring principle, has a pressure measuring device ~~(15)~~ which is arranged in the pressure chamber ~~(19)~~ and with which the pressure in the pressure chamber ~~(19)~~ can be determined, wherein the pressure in the pressure chamber ~~(19)~~ forms a basis for the metering of the amount of fluid required for the opening process.

2. Self-emptying separator according to claim 1, characterized in that the control assembly ~~(28)~~ has an injection chamber ~~(8)~~ for opening fluid, to which the fluid, in particular water, can be fed via an opening fluid supply ~~(10)~~, in which an opening fluid valve ~~(12)~~ is arranged, for activating opening movements.

3. Self-emptying separator according to one of the preceding claims, characterized in that the metering element ~~(17)~~ is designed as a piston or as a diaphragm.

4. Self-emptying separator according to one of the preceding claims, characterized in that the pressure chamber ~~(19)~~ has a temperature sensor.

5. Self-emptying separator according to one of the preceding claims, characterized in that the volume of the pressure chamber ~~(19)~~ is dimensioned in such a way that, even when the fluid chamber ~~(18)~~ is filled to the maximum, the pressure in the fluid

supply line ~~(20)~~ is still higher than a counterpressure P in the pressure chamber ~~(19)~~.

6. Self-emptying separator according to one of the preceding claims, characterized in that the fluid chamber ~~(18)~~ is connected between a filling valve ~~(21)~~ and the opening fluid valve ~~(12)~~.

7. Self-emptying separator according to one of the preceding claims, characterized in that an orifice plate is incorporated into the fluid supply line ~~(20)~~.

8. Self-emptying separator according to one of the preceding claims, characterized in that the orifice is arranged immediately upstream of the filling valve ~~(21)~~.

9. Method for performing a solids discharge in a processing of a flowable product with a separator according to one of the preceding claims, characterized by the method steps of:

   a. providing a self-emptying separator according to one of the preceding claims and processing a flowable product to be processed, separating it at least into a liquid phase and a solid phase;
   b. opening of a filling valve ~~(21)~~, causing the metering element ~~(17)~~ to move towards of the pressure chamber ~~(19)~~ due to the incoming fluid, wherein the pressure in the pressure chamber ~~(19)~~ increases;
   c. carrying out a measurement or repeated measurements in or on the pressure chamber ~~(19)~~ with a measuring device ~~(15)~~ and comparing the measurement result with a preset value manually or with a control unit ~~(24)~~, wherein in step c) the pressure (P) in the pressure chamber is measured with a pressure measuring device ~~(15)~~ and the measured pressure is compared with a predetermined pressure as default value manually or with a control device ~~(24)~~;
   d. closing the filling valve ~~(21)~~ when the measured value corresponds to the default value; so that a metered opening fluid volume is present in the fluid chamber ~~(18)~~, wherein in step d) a closing of the filling valve ~~(21)~~ takes place when the measured pressure corresponds to the predetermined pressure; so that the metered opening fluid volume is present in the fluid chamber ~~(18)~~;
   e. opening the opening fluid valve ~~(12)~~ and the valve ~~(23)~~ of a compressed air line ~~(22)~~ to inject the metered opening fluid volume in the fluid chamber

~~(18)~~ into the separator via an opening fluid supply ~~(10)~~ and an injection chamber ~~(8)~~ for opening fluid, to open the piston valve ~~(25)~~ and to thereby move a piston valve ~~(6)~~ from a closed position to an open position so that the solids discharge openings ~~(7)~~ are released and the solids phase is discharged from the centrifugal drum ~~(1)~~.