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(54) **ADJUSTABLE VOLUME FLOW REGULATOR, FOR AIR FLOW IN AIR DISTRIBUTION DEVICES**

(57) Regulator has a channel for flow of the fluid where the throttle (1) is tiltably placed. The adjustment mechanism of the throttle (1) has a lever (2) in the axis of the valve (1); the spring (3) with the adjustable pre-stress in the direction of the torque force arising on the throttle (1) during the flow of the fluid in the channel acts upon the lever (2). The mechanism has a damper (5) with the arm (7) which is connected to the lever (2) of the throttle. The damper (5) is placed on the slidably placed holder (6) which achieves the varying position of the damper (5) against the axis of the throttle (1); the varying

position of the holder (6) corresponds to varying gear ratio of the rotation between the lever (2) and the damper (5). It is preferable if the adjustment element (4) is connected to the holder (6) by a gear for coupling of the position of the adjustment element (4) with the position of the holder (6). In order to increase the precision of the regulator it is preferable if it has a plate (13) which is placed just behind the shaft of the throttle (1) and the direction of the flow of the fluid, and if the throttle (1) is balanced with the lever (2).

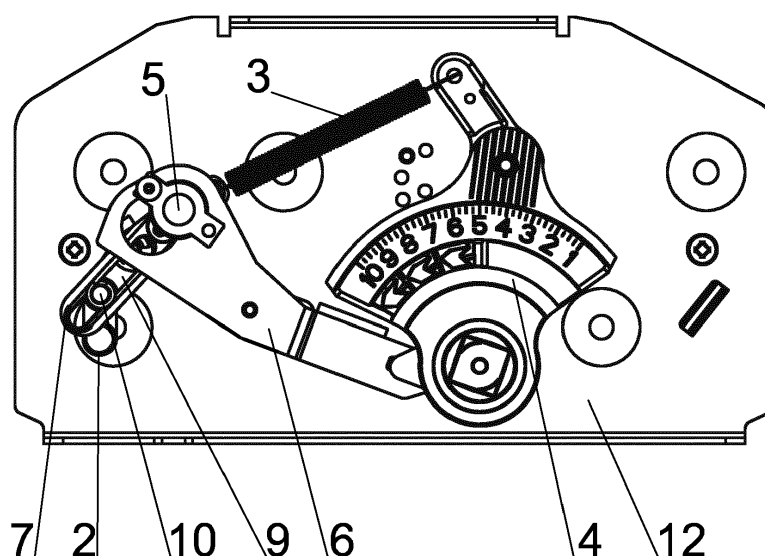


Fig. 10

Description**Field of technology**

5 **[0001]** Technical solution concerns a regulator of the flow of fluids with the throttle, especially for the flow of the air in air distributing elements, systems and distribution pipes of various cross-sections and dimensions. The throttle regulates the flow in cooperation with the adjusting mechanism which can adapt to a change in entry pressure conditions and keeps the adjusted flow of the fluid in broad range.

10 **Prior state of the art**

15 **[0002]** Throttles are used for regulations of the flow of the air and similar gases, whereby these throttles interfere with the flow of the fluid and pursuant to the angle of rotation they pose varying resistance to the flowing fluid. In order to set the correct angle of the flow the electronic control systems can be used, whereby these systems determine the actual flow by assessing the pressure, and subsequently they control the orientation of the throttle. Usually, the mechanically regulated throttles are used for air systems, which is simple, cheap and does not require a power supply.

20 **[0003]** The flat sheet of the throttle of the mechanic regulator is bent at the level of the axis of rotation so that the first side of the throttle creates a different torque force than the other side of the throttle. The resulting difference in torque during the flow of the fluid is kept in balance by the spring force which has adjustable prestress (preload). The prestress adjusts the desired flow. The shape of the sheet of the throttle corresponds to the cross-section of the pipe - or the cross-section of the regulating element, respectively - in which the throttle is placed. Multiple types of regulators with varying kinematics of the adjustment mechanism operate on this principle.

25 **[0004]** The solution according to DE9208345U1 uses a flat spring (leaf spring) which is connected with the adjustable cam. The solution is simple, but the adjustment mechanism lacks sufficient own or added cushioning and it will be prone to vibration. Publication EP1840477A2 uses a flat spring, too, which acts against the torque force of the throttle which has an axis of rotation moved outside the geometrical axis. The disadvantage is that the throttle is prone to vibrations and imprecisions of the adjustment of the flow.

30 **[0005]** Solutions according to EP 1318359 A2, SK UV 3174 U use pneumatic linear damper which should prevent the vibration of the throttle. It has been found out that in practice in some regimes the damping is insufficient and the system is prone to vibration or hysteresis, where the actual flow depends on whether the entry pressure rises or decreases, to which the throttle reacts by opening or closing. Publication DE102010038150A1 discloses a rotational damper which acts through the toothed gear upon the throttle. The damping is the same at various angles of rotation of the throttle, which causes problems with regulation. The mechanism according to publication EP 2940396 A1 has many components and lacks the damping of the movement of the throttle.

35 **[0006]** The disadvantage of the hitherto known solutions of regulators with the mechanical adjustment of the throttle is also the fact that they can be used in one mounting position only; in other position the imprecision of the regulation increases significantly.

40 **[0007]** Such solution of the regulator is desired and not known, which will maintain the set flow of the fluid, mainly air, in various pressure conditions at the entry; and which will prevent the vibration of the valve or throttle - which is common cause of the instability of the flow in distribution system. The solution should be usable for various sizes of the flow cross-sections.

Essence of technical invention

45 **[0008]** The abovementioned deficiencies are significantly remedied by the adjustable regulator of the flow of fluids, mainly air in air distribution systems, where the regulator has a channel for the flow of fluid; the throttle is tiltably deposited in the body of the channel; the throttle has an adjustment mechanism placed outside the channel; the adjustment mechanism includes a lever of the throttle, through which the spring with the adjustable prestress acts; and where the regulator has a rotational damper of the vibration of the throttle and it has an adjustable element for the change of prestress of the spring, according to this technical solution which essence lies in the fact that the damper has an arm which is connected with the lever of the throttle, whereby the damper is placed on a tiltably deposited holder in order to achieve various position of the damper against the lever of the throttle, which achieves varying gear ratio between the lever of the throttle and the damper.

50 **[0009]** In this solution the rotational damper of vibrations with the arm is used; the damper is active in the adjustment mechanism only in a given angular scope; its ability to rotate unlimitedly is not completely used. Thanks to the arm and the adjustable position of the holder with the damper, a varying gear ratio between the throttle and the rotational damper can be achieved. The changeable gear ratio between the rotation of the throttle and the rotation of the damper allows to suitably choose the size of damping at varying settings of the prestress of the spring; that is, the varying damping

effect is achieved at variously set flows of the regulator.

[0010] The holder of the damper can be arranged in such a way that in some set position - for example, in the position with the maximum flow - the gear ratio between the rotation of the throttle and the rotation of the damper is close to 1:1. The holder can in such arrangement be placed in such a way that in a given extreme position the axis of the damper is close to the axis of the deposition of the throttle or within the axis of the deposition of the throttle. The lever of the throttle acts upon the arm of the damper by means of a pin. In order to allow the change of the position of the damper while - at the same time - the kinematic bond between the throttle and the damper is preserved, the lever of the throttle or the arm of the damper has a radially oriented groove to which the pin - fixedly attached to the other member of the gear - falls. From the point of view of simple construction it is preferable if the pin is fixedly inserted in the lever of the throttle and the radially oriented groove is produced in the arm of the damper. The pin falls into the groove in the arm of the damper; the pin during the movement in the direction of the tangent acts upon the arm and in this direction the pin has only the necessary gap; by this method the angular change of the position of the throttle is transferred to the change of the angle of the rotational damper.

[0011] The geometry of the kinematic relation between the damper with the arm and the lever of the throttle also causes that the gear ratio - that is, angle drive between the rotation of the throttle and the rotation of the damper - changes even if the position of the holder with the damper is given and unchangeable. This change of the gear ratio is smaller than the change of the gear ratio caused by the gradual change of the position of the damper relative to the axis of the rotation of the throttle, and this change stems from the use of the lever gear. If the holder with the damper is placed in such a way that its axis of rotation gets into the axis of rotation (tilting) of the throttle, the lever gear from the throttle to the damper will produce gear ratio 1:1 and the lever and the arm will form a coupled crank. During deviation from the coaxial position not only the gear ratio changes by the change of the position of the damper, but during the change of the orientation of the throttle an effective ration of the lever and arm changes, too. This arrangement ensures a non-linear course of the damping during use of a simple rotational damper with basically constant course of the damping.

[0012] Various dimensional and spatial arrangements and placements of the holder with the damper against the lever of the throttle, or against the axis of the throttle, respectively, allow achieving various course of the damping depending on the angular position of the throttle and the setting of the holder of the damper. A holder of the damper has been invented as reliable and simple, which is rotationally or tiltably, respectively, placed in such a way that the circle - or part of the circle, respectively -, which defines available points of the axis of rotation of the damper, runs in various positions of the holder through the axis, or in the vicinity of the axis of the throttle, respectively. This can concern the outermost position corresponding to the maximally set flow of the regulator. When the desired flow is decrease, the holder with the damper rotates in such a way that the axis of the damper draws apart from the axis of the rotation of the throttle.

[0013] The independent adjusting or stopping member can be used for adjustment of the position of the holder with the rotational damper against the axis of the throttle and the lever of the throttle; this member can - according to a table - set the holder of the damper to the position for a desired respective flow of the fluid; or it preferably creates a mechanical connection of the holder of the damper with the adjustment element for the adjustment of the prestress of the spring. It is therefore preferable if the adjustment element for the change of the prestress of the spring is a connected by a gear to the holder of the damper. The term "spring" in this description means any element which allows for elastic deformation at least in one direction; it can be a flat leaf spring, it can be a torsion spring, spiral spring, helical coil compression spring, draw spring (extension spring), and so on. Pursuant to the type of the used spring the adjustable element can be produced differently; usually it will involve a lock for the desired position of the adjustable element.

[0014] In the preferable arrangement of the regulator a linearly acting draw spring is used; this spring is at one end connected to the lever of the throttle and on the other end it is connected to the adjustable element. The adjustment element changes the prestress of the spring, it has a lock of the set position, and preferably it has an indicator or scale of the setting, respectively. In order to produce the kinematic bond between the adjustable element and the holder of the damper a toothing can be used, or - as has been proved preferable - a simple lever gear. For example on the circumference of the rotationally adjustable element there is a stud which acts in an opening or a groove in the holder of the damper. The holder of the damper is placed tiltably; during the setting of the desired position of the adjustment element the angular orientation of the holder of the damper changes, too, and thereby the position of the damper relative to the axis of the rotation of the throttle changes, too. The change of the setting of the prestress of the spring is therefore coupled with the necessary change of the position of the damper.

[0015] A base plate attached from the outer side of the body of the channel is used for the placement of the holder with the damper and for the placement of the adjustment element with the spring. The isolation for a decrease of the transfer of the heat or noise can be placed between the body of the channel and the base plate.

[0016] The proposed technical solution is suppressing the undesired vibration by a simple and reliable construction and it lowers the hysteresis even when the entry conditions change, mainly during the increase or decrease of the entry pressure of the air.

[0017] The flat plate placed just behind the axis of the throttle in the direction of the flow of the fluid has positive effect on the increase of the precision of the resulting flow of the regulator. The plate prevents the vibrations behind the sheet

of the regulation valve or throttle, respectively. The plate is oriented in the direction of the flow in the regulator's channel and it has length which is at least half the height of the channel, preferably its length corresponds to the height of the channel. The plate can have a stop for the completely open throttle. In case the plate is produced from steel plate, the stop can be produced as a rim with a required height. The stop of the opposite position for the maximally open throttle

can be in the inner coat of the body of the channel, for example in a simple way for protruding shaft of the blind rivet.
[0018] The plate behind the throttle separates the flows of the fluid which come from behind the throttle from its differently sloped sides of the sheet; it prevents the mixing of these flows behind the throttle. It is preferable if the plate is placed in such a way that its front side is placed just behind the axis of rotation of the throttle with the gap necessary for the smooth rotation of the throttle, whereby the plate is parallel with the direction of the flow and it separates the space behind the throttle to two similarly large spaces. The back edge of the plate can have straight or rounded course in the groundplan. Preferably the throttle will be produced from the sheet; the bent edges will be riveted to the inner surface of the channel's coat. In cases of large diameters of the channel of the regulator the plate can have a fold in the vicinity of the placement of the throttle. The strengthening fold can be part of the deposition of the plate, which simplifies the approach of the front edge of the plate to the shaft of the throttle during the placement of the plate in the middle of the pipe of the regulator.

[0019] The disclosed technical solution ensures reliable regulation of the constant flow of the fluid. The set flow is kept at the required precision during increase and decrease of the pressure in the entry side of the regulator; the reaction of the valve to the changing entry overpressure is fast and without vibrations.

[0020] In order to limit the influence of varying mounting position of the regulator on the precision of the regulation of the constant flow, it is preferable if the throttle together with the lever is balanced, or at least statically balanced relative to the axis of rotation. Since the sheet of the throttle in case of a regulator according to this technical solution is either bent or offset, the throttle has a tendency to descend or rotate towards one position in order to achieve different torque force at the sides of the throttle. This affects the regulation moment acting upon the throttle, which can be simply solved by having the measurement and calibration of the regulator done at a given position, usually at horizontal position of the channel with horizontally oriented axis of rotation of the throttle. In order to achieve identical results after mounting of the regulator to the air distribution system, the exact position is prescribed for installation, too. If, however, the throttle together with the attached lever is balanced in such a way that in various positions and orientations there is no further moment acting in one direction of the rotation of the throttle, the regulator can be used in any position. The mass of some component of the throttle can be preferably used for balancing of the throttle, for example larger parts of the connecting mean which connects the shaft of the throttle with the sheet of the throttle. For example, enlarged head of the screw or blind closed nut have a weight acting in opposite direction compared to bending of the sheet of the throttle. The static balancing of the throttle together with the non-linearly acting damping increases the precision of the desired constant flow.

[0021] The regulators of constant flow are used in various sizes of pipes and in broad scale of flows. Usually the regulators are built for diameters from 80 mm to 500 mm, which is approximately 40 times the difference in the flow cross-section. Even though the principle disclosed in the description of this technical solution is universally available for all common diameters and cross-section shapes of the regulators, it will be necessary to produce different parameters of kinematic bonds between the lever and the adjustment element. If one does not want to produce different components of the mechanism for each size of the regulator, it is preferable if the components have adjustment openings, adjustable stops and so on. The lever of the throttle can have multiple openings for attachment of the draw spring. The draw spring then acts on the different arm of the lever. At the same time the lever can have multiple positions of the pin which falls into the groove in the arm of the damper. One product of the lever (for example plastic pressing of the lever) can then be connected to the throttle of the regulator with diameter for example from 80 mm to 200 mm. The holder of the damper can have opening or openings for two or multiple placements of the damper. The rotational damper which is produced as a readymade component for multiple applications can be designed for the regulator with varying damping effect and for various diameters. In case the variously tiered set of dampers have different connections to the shaft, it will be preferable if the pressing of the arm of the damper has openings in various necessary shapes, so that one pressing of the arm can be used for multiple dimensions of the regulator.

[0022] With some dimensions of the regulator, for example, with dimensions larger than 200 mm it may be necessary to use a spring with non-linear course of the draw force. In order to achieve this with the existing geometry and kinematics of the adjustment mechanism, a set of at least two helical draw springs, where one spring is in constant grip between the adjustment element and the lever of the throttle and the second spring enters into the grip only after the backlash has been exhausted; the backlash can be produced and defined by the length of the free groove in which one end of the second spring moves. The free groove can be part of a draw rod which is together with the second spring placed inside the first spring, which saves the space in the adjustment mechanism.

[0023] A re-adjustment of the stop of the position of the adjustment element, set for maximum flow, can be used for adaptation of a single adjustment mechanism for various diameters of a regulator. This stop can be created by a shaft of the blind rivet which is riveted in some opening in the group of openings in the base plate. The base plate can have

one end stop for maximum position of the rotation of the adjustment element. The lock of the desired position of the adjustment element can be solved by means of a screw which produces friction joint of the adjustment element with the base plate or with a cover which is connected with the base plate. The cover can create a support for the rotational or tiltable placement of some element or some elements of the adjustment mechanism. The outer surface of the cover can have connecting elements or connecting wiring for attachment of the action member which can change the position of the adjustment element according to instructions from the superior system. The regulation of the constant flow itself is in the regulator ensured by the mechanical arrangement according to this solution; but the change of the desired flow can be remotely controlled, too.

[0024] The advantage of the technical solution is mainly its simple and reliable construction which ensures non-linear operation of the spring and the damper even with small number of components and it ensures repeatedly precise maintenance of the set flow without problems with hysteresis or vibration. The adjustment mechanism is adaptable for broad scale of the cross-section of the regulator.

Description of drawings

[0025] The technical solution is further disclosed by means of pictures 1 to 22. The depicted construction details are only examples and cannot be interpreted as limiting the scope of protection.

Figures 1 to 4 depict the kinematic scheme of the adjustment mechanism of the regulator in various positions. On these figures the holder of the damper is for the sake of clarity moved in such a way that it does not overlap the lever of the throttle in groundplan depiction. In subsequent figures the holder is depicted in such a way that the line of the axis of the rotational damper runs through the axis of the throttle during the change of position.

Figure 1 presents a position with the adjustable element in maximal position of the flow; it is in position "10" from the ten-tier scale, where the gear ration between the rotation of the throttle and the rotation of the arm of the damper is close to 1:1. On figure 2 there is the same adjustment mechanism depicted in the position with flow in the position "2" from the ten-tier scale, whereby the throttle is in the same position as the one on the figure 1, which at varying strength of the spring signals different entry pressure compared to figure 1. At figures 1 and 2 the throttle is not depicted for the sake of clarity. At figure 2 it can be observed that the lever of the throttle acts upon the arm of the rotational damper and in different semi-diameter as in example 1.

On figures 3 and 4 the same position of the adjustment mechanism is depicted, but the throttle - depicted by the dashed line - has varying position depending on the entry pressure in the regulator. The position of the throttle and the lever at figure 3 corresponds to the high pressure; the position on figure 4 corresponds to the lower pressure at the entry of the regulator.

Figure 5 is a view of the regulator with the circular cross-section from the side of the adjustment mechanism. Figure 6 is a view from the entry side. Figure 7 is a view of the adjustment mechanism with the unscrewed screw of the lock.

Figures 8 and 9 depict the adjustment mechanism after the removal of the cover, whereby at both figures the holder of the damper is depicted as transparent by the dashed line. Figure 8 is a holder of the damper in the position of the flow set low, where the arm of the lever on which the throttle acts upon the damper is denoted as "A". Figure 9 is a position of the maximum flow; the holder with the damper is moved to the vicinity of the axis of the throttle and the arm of the lever is denoted as "B", whereby this arm is visibly smaller than "A" dimension in figure 8.

Figure 10 is a view of the uncovered adjustment mechanism; the concentric pairs of circles on the base plate are rims which produce better contact with the circular profile of the channel of the regulator. The upper view of the uncovered adjustment mechanism is on figure 11. The detail of free placement of the arm of the damper is then on the figure 12.

Figure 13 is a side view of the elements of the adjustment mechanism.

Figures 14 to 17 depict the adjustment mechanism used for larger diameters of the regulator, where the lever is produced as a sheet plate pressing and where two springs are used. On figure 14 the circular rims on the base plate have been left out for the sake of clarity, and the holder of the damper is depicted as transparent.

Figure 15 is a view in B-B cross-section from figure 14.

Figure 16 is a view in A-A cross-section from figure 14.

Figure 17 is a detail of the connection of the pin of the lever to the arm of the damper, whereby the damper is depicted without its holder.

Figures 18 and 19 depict the regulator with the circular cross-section without the adjustment mechanism. Figure 18 is a view of the open throttle set to maximum in the plate. Figure 19 is upper view, where the length of the plate can be seen.

Figure 20 is a detail of the placement of the plate in the vicinity of the shaft of the throttle.

Figure 21 depicts a throttle for larger diameters of the regulator, where the throttle has reinforcing rib and the plate has a fold drawing the front edge of the plate near to the shaft of the throttle.

Figure 22 is a detail of the connection of the throttle tiltably to the deposited shaft, where the robust nut creates balancing matter.

Examples of realization

Example 1

[0026] In this example according to figures 1 to 13 and 20, 22, the body of the channel of the regulator is formed by a piece of the circular steel galvanized pipe with the seals at the ends, which are designed for connection to the pipes of the air distribution systems. In the pipe, in this example the diameter is 160 mm; the throttle 1 from aluminum sheet is deposited on the plastic sockets. The sheet of the throttle 1 has circular groundplan with short circular segment. The sheet of the throttle 1 has an insert produced in its middle, whereby the shaft of the throttle 1 is demountably deposited to the insert. The shaft is connected with the sheet of the throttle 1 by two screws; the nuts of these screws create a balancing matter. The sheet of the throttle 1 is folded through the line of the shaft in such a way that the lower and upper parts of the sheet are bended in 14°.

[0027] Behind the throttle 1 a plate 13 from the galvanized metal sheet is riveted in the direction of the flow of the air; this plate 13 divides the space behind the throttle 1 and thereby separates the flows of the air flowing by the sides of the throttle 1. The plate 13 is oriented in parallel with the direction of the flow of the air; it has a short trigger cut and bent upward which forms the stop 14 of the throttle 1 in its most open position. The opposite stop 14 of the throttle 1 for the most closed position is the shaft of the blind rivet in the upper part of the pipe. The throttle 1 is capable of gradual rotation and tilting between the stops 14.

[0028] The shaft of the throttle 1 on the side of the adjustable mechanism runs outside the pipe, where it runs through the opening in the base plate 12. The base plate 12 carries the adjustment mechanism and the cover 15. The base plate 12 is screwed to the pipe by self-tapping screw; between the base plate and the outer surface of the pipe there is foam isolation.

[0029] At the end of the shaft of the throttle 1 the two-arm lever 2 in form of a plastic pressing is deposited. At one arm of the lever 2 there is a set of four openings for the connection of the spring 3. At the second arm of the lever the steel pin 10 is pressed in. On the base plate 12 the holder 6 of the damper 5 is freely placed. The holder 6 is produced by bending of the metal sheet cut-out and it has a function of the two-arm lever. On one side in the holder 6 there is an opening allowing the deposition of the damper 5 in two positions; at the other end the holder has a fork. The rotational damper 5 is placed into the opening in the holder 6 and it is attached by the rivet. On the axis of the holder 6 the plastic arm 7 is mounted, which has two attaching openings with various shape for two different axes of the dampers 5. The arm 7 has a groove 9 produced, whereby the pin 10 from the lever 2 falls into this groove 9. It has a lock ring mounted so that the pin 10 is not released from the groove 9.

[0030] The adjustment element 4 for the setting of the prestress of the spring 3 is a plastic pressing with the scale on the circular arc. The axis of the adjustment element 4 has a quadrilateral opening designed for the insertion of the control device or for the connection with the output of the control servomotor. The axis of the adjustment element 4 is rotationally mounted in the opening of the base plate 12 and in the opposite opening in the cover 15. The adjustment element 4 has first, longer arm, at the end of which there are two openings for the connection of the spring 3. On the first arm the nut is pressed in, whereby the screw of the lock 16 runs into the nut. The screw of the stop 16 connects the adjustment element 4 with the cover 15 by friction joint; the groove is led in the arc in the cover 15 as well as window for the reading of the set position on the scale in the adjustment element 4. The cover 15 in this example of the realization transfers the first from the adjustment element 4 and from the spring 3; it is therefore produced as sufficiently strong pressing with the leads for precise clicking into the bent edges of the base plate 12.

[0031] The second, shorter arm on the pressing of the adjustment element 4 is ended by the stud 11 which falls into the fork in the holder 6 of the damper 5. During the rotation of the adjustment element 4 the prestress of the spring 3 changes and at the same time the stud 11 rotates the holder 6 through the fork. During the setting of the maximal flow to "10" of the ten-tier scale the first arm of the adjustment element 4 leans onto the pressed through stop on the base plate. At the same time the holder 6 is in the position where the axis of the rotational damper 5 is approximately in the axis of the throttle 1. In this position their mutual gear ratio between the rotation of the throttle 1 and rotation of the damper 5 is close to 1:1.

[0032] The air led to the entry of the regulator rotates the throttle 1 according to the degree of the entry pressure. The changes in the pressure lead to the change of the position of the throttle 1. The throttle 1 is at the same time drawn towards the maximal opening, all the way to stop 14 on the plate 13. The increasing pressure at the entry gradually closes the throttle 1.

[0033] During the rotation of the adjustment element 4 towards the smaller values of the flow the damper 5 distances itself from the axis of the throttle 1, which changes the gear ratio between the throttle 1 and the damper 5; the damper 5 now acts against the changes in the position of the throttle 1 with the smaller damping resistance. Since with smaller flows of the air and with given diameter of the regulator the achievement of the constant flow is imprecise, the lower level of the setting is limited in such a way that the shaft of the blind rivet protrudes from the base plate 12 in such a way that it creates a stop of the first arm of the adjustment element 4, which allows to set the regulator even to level "2". In this example of realization the regulator has following regulation spread with entry pressure from 50 to 1000 Pa:

level	1	2	3	4	5	6	7	8	9	10
flow l/s	-	23	31	38	46	53	58	63	68	73

[0034] The pipe of the regulator is covered in heat and sonic isolation from the outside.

Example 2

[0035] In this example the cover 15 is connected to the servomotor whose output shaft with the quadrilateral cross-section falls into the opening in the adjustment element 4. An attachment element 8 pressed on the cover 15 serves for simple connection. The lock 16 is released and the servomotor changes the degree of the adjustment element according to instructions from the central system of the control of the building. The regulation of the rotation of the throttle 1 is still directed by the mechanism without the electronic circuits; similarly as in example 1.

Example 3

[0036] In this example the setting of the holder 6 with the position of the damper 5 is independent; it is separated from the position of the adjustment element 4. The adjustment element 4 and the holder 6 have their own scale. When setting the desired flow the personnel sets the position of the adjustment element 4 and the position of the holder 6 of the damper 5 according to table glued to the cover 15.

Example 4

[0037] The adjustable regulator of the constant flow with the larger diameter (for example 400 mm) according to figures 14 to 17 and 21 uses a metal lever 2 of the throttle 1 which has sufficient solidity and strength for enduring increased bending stress compared to the solution with the plastic lever 2. The adjustment mechanism has two springs 3. The first, larger spring 3 is directly connected between the adjustment element 4 and the lever 2. The second, smaller spring 3 is placed inside the first spring 3 and it engages into the second opening in the adjustment element 4 by the draw rod with the groove. The length of the groove defines backlash in which the second spring 3 does not engage and does not act by force upon the lever 2. After the preset pulling of the first spring 3 the backlash is exhausted and second spring 3 gets into the grip, too, which causes the desired force non-linearity.

Industrial applicability

[0038] Industrial applicability is obvious. According to this technical solution it is possible to repeatedly and industrially produce and use the regulator of the flow of fluids, mainly air in the air distribution systems, for example air conditioning, ventilation or heating systems, whereby the regulator maintains the set flow on the basis of mechanical bonds without the electric control and without the undesired hysteresis.

List of related symbols

[0039]

- 5 1 - throttle
- 2 - lever of the throttle
- 3 - spring
- 10 4 - adjustment element
- 5 - damper
- 15 6 - holder of the damper
- 7 - arm
- 8 - attachment element
- 20 9 - groove
- 10 - pin
- 25 11 - stud
- 12 - base plate
- 13 - plate
- 30 14 - stop of the throttle
- 15 - cover
- 35 16 - lock of the adjustment element

Claims

- 40 1. An adjustable regulator for a flow of fluids, mainly an air in an air distribution devices, which has a channel for the flow of the fluid; in a body delimiting the channel there is a tiltably placed throttle (1), which has an adjustment mechanism outside the channel, where
- the adjustment mechanism involves a lever (2) on an axis of the throttle (1); a spring (3) with an adjustable prestress acts upon the lever (2) in a direction against a torque force which arises on the throttle (1) during the flow of the fluid
- 45 in the channel,
- whereby the regulator has a rotational damper (5) of a rotation of the throttle (1) and it has an adjustment element (4) for a change of the prestress of the spring (3),
- is characterized by the fact, that**
- the damper (5) has an arm (7) which is connected with the lever (2) of the throttle (1) for a transfer of angular changes
- 50 of the throttle (1) to the damper (5);
- the damper (5) is movably placed on a holder (6) in order to achieve a varying position of the damper (5) against the axis of the throttle (1) for varying settings of the desired flow;
- whereby the varying position of the holder (6) corresponds to a varying gear ratio between an angular orientation
- 55 of the lever (2) and the damper (5).
2. The adjustable regulator of the flow of the fluids, mainly the air in the air distribution devices according to the claim 1 is **characterized by the fact**, that the arm (7) has a radially oriented groove (9), whereby a pin (10) connected with the lever (2) of the throttle (1) falls into the groove (9).

3. The adjustable regulator of the flow of the fluids, mainly the air in the air distribution devices according to the claim 1 or 2 is **characterized by the fact**, that a line of an axis of the damper (5) corresponding to various positions of the setting of the holder (6) runs through the axis or by the axis of the throttle (1); preferably it runs through the axis or by the axis of the throttle (1) in a position corresponding to the set maximal flow of the fluid.
- 5
4. The adjustable regulator of the flow of the fluids, mainly the air in the air distribution devices according to any of the claims 1 to 3 is **characterized by the fact**, that the holder (6) of the damper (5) is a tiltably deposited lever, preferably the two-arm lever.
- 10
5. The adjustable regulator of the flow of the fluids, mainly the air in the air distribution devices according to any of the claims 1 to 4 is **characterized by the fact**, that the adjustment element (4) is connected with the holder (6) by a gear for coupling of a position of the adjustment element (4) with the position of the holder (6); preferably the adjustment element (4) has a stud (11) acting upon a fork in the holder (6).
- 15
6. The adjustable regulator of the flow of the fluids, mainly the air in the air distribution devices according to any of the claims 1 to 5 is **characterized by the fact**, that it has a base plate (12) on which the holder (6) is deposited; the base plate (12) is connected to the body of the channel; preferably an isolation is placed between the body of the channel and the base plate (12).
- 20
7. The adjustable regulator of the flow of the fluids, mainly the air in the air distribution devices according to any of the claims 1 to 6 is **characterized by the fact**, that it has a cover (15) covering the adjustment mechanism, whereby the cover (15) is removably attached to the base plate (12); preferably the cover (15) has a groove for a lock (16) of the adjustment element (4).
- 25
8. The adjustable regulator of the flow of the fluids, mainly the air in the air distribution devices according to any of the claims 1 to 7 is **characterized by the fact**, that the adjustment element (4) has a scale and the cover (15) has a window through which a set degree of the position of the adjustable element (4) is displayed.
- 30
9. The adjustable regulator of the flow of the fluids, mainly the air in the air distribution devices according to any of the claims 1 to 8 is **characterized by the fact**, that the base plate (12) has a stop defining a scope of available positions of the adjustment element (4).
- 35
10. The adjustable regulator of the flow of the fluids, mainly the air in the air distribution devices according to any of the claims 1 to 9 is **characterized by the fact**, that the lever (2) and/or the holder (6) and/or the arm (7) and/or the adjustable element (4) has at least two positions of a connection co-acting upon components, and/or it has at least two positions of its deposition.
- 40
11. The adjustable regulator of the flow of the fluids, mainly the air in the air distribution devices according to any of the claims 1 to 10 is **characterized by the fact**, that it has a flat plate (13) which is placed just behind a shaft of the throttle (1) in the direction of the flow of the fluid, whereby the plate (13) is parallel with the direction of the flow of the fluid and its length is at least half the height of the channel; preferably the plate (13) has a stop (14) for a maximal opening of the throttle (1).
- 45
12. The adjustable regulator of the flow of the fluids, mainly the air in the air distribution devices according to any of the claims 1 to 11 is **characterized by the fact**, that the throttle (1) together with the lever (2) is balanced towards the axis of rotation; preferably connecting elements for the connection of the throttle (1) with the shaft involve a balancing matter.
- 50
13. The adjustable regulator of the flow of the fluids, mainly the air in the air distribution devices according to any of the claims 1 to 12 is **characterized by the fact**, that the cover (15) has an attaching element (8) for a leading or an attachment of a servomotor whose rotational output is designed for a control of the adjustment element (4).
- 55
14. The adjustable regulator of the flow of the fluids, mainly the air in the air distribution devices according to any of the claims 1 to 13 is **characterized by the fact**, that it has two springs (3) acting upon the lever (2), whereby the first spring (3) is connected to a grip through a groove which creates a backlash without pulling or drawing of the second spring (3); preferably the second spring (3) is placed inside the first spring (3) and the groove of the backlash is produced on a draw rod which connects the second spring (3) with the lever (2) or with the adjustment element (4).

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15. The adjustable regulator of the flow of the fluids, mainly the air in the air distribution devices according to any of the claims 11 to 14 is **characterized by the fact**, that the plate (13) has a reinforcement fold in a vicinity of the shaft of the throttle (1); preferably the fold is a part of the vertical deposition of the plate (13).

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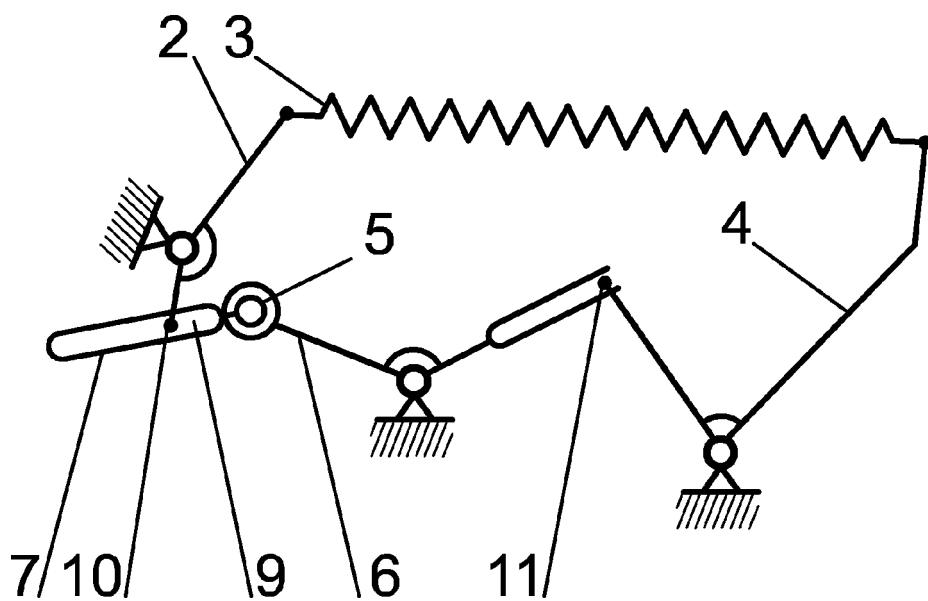


Fig. 1

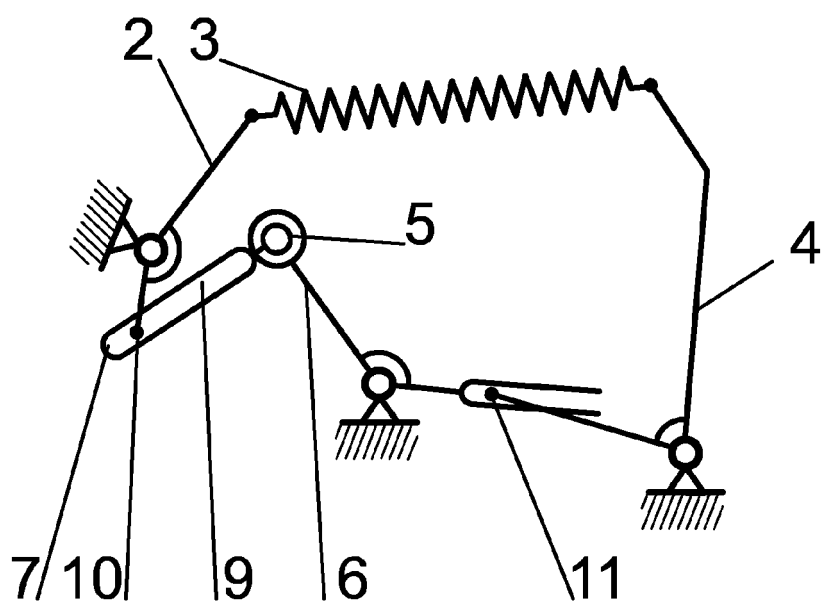


Fig. 2

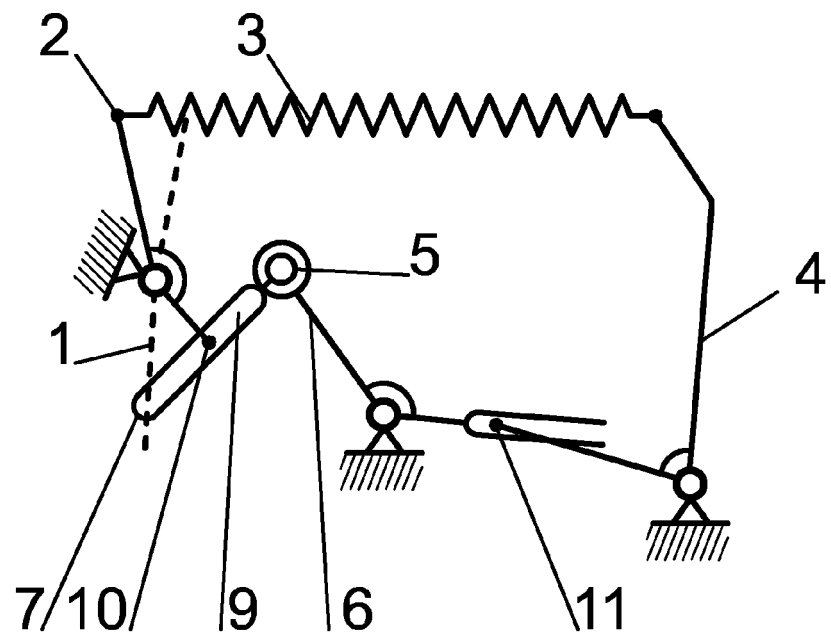


Fig. 3

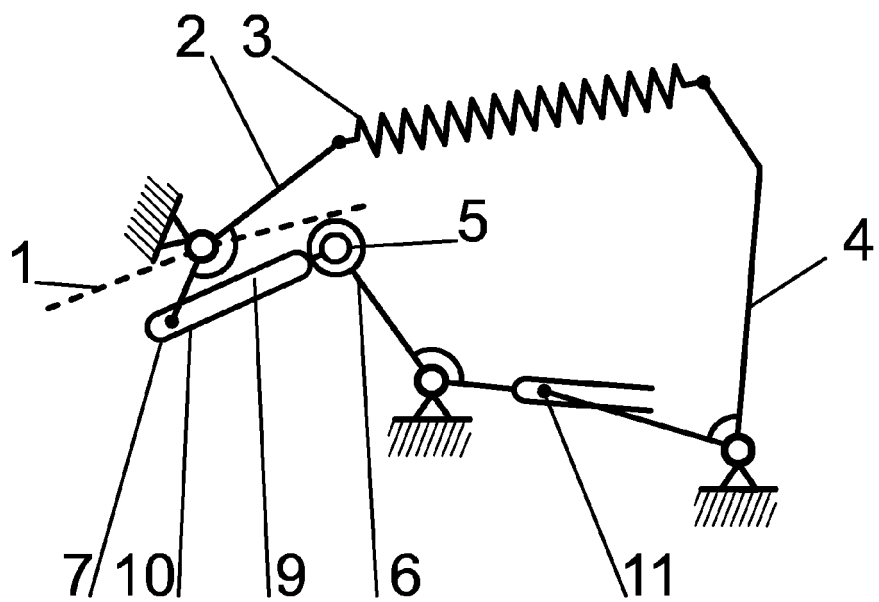


Fig. 4

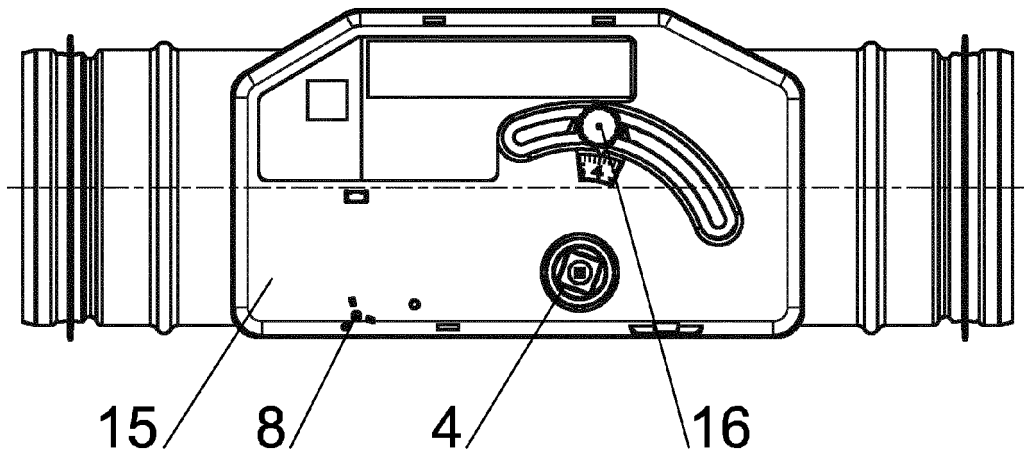


Fig. 5

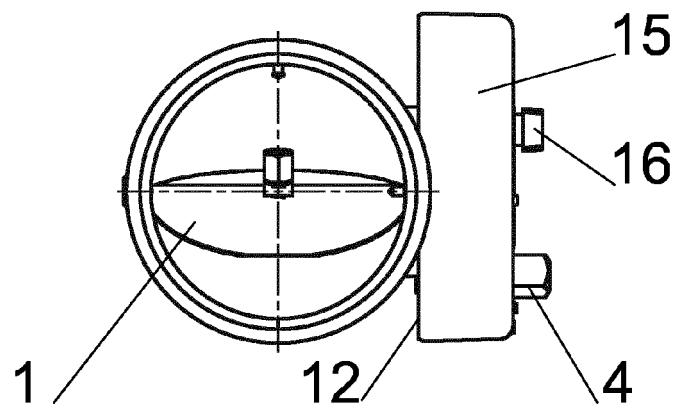


Fig. 6

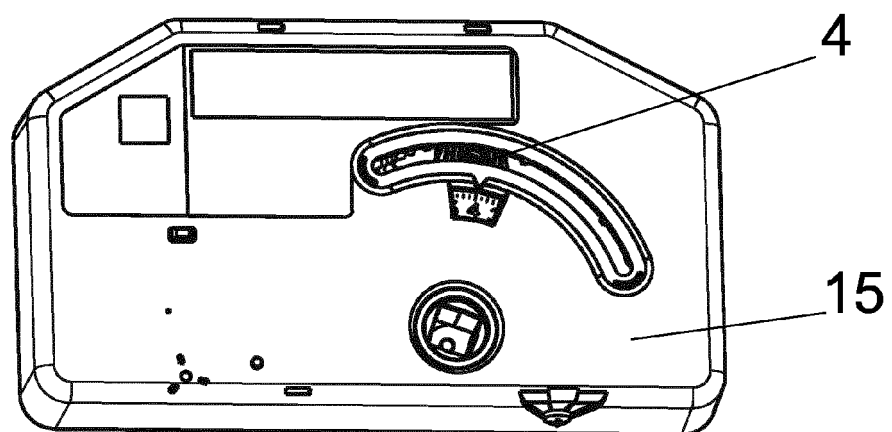


Fig. 7

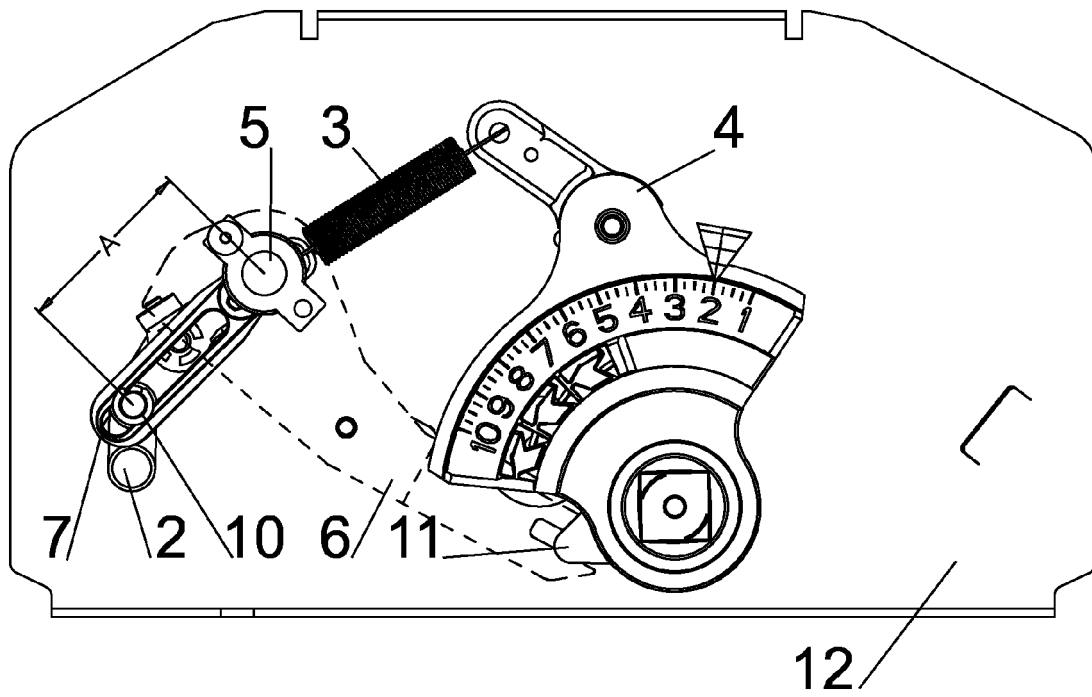


Fig. 8

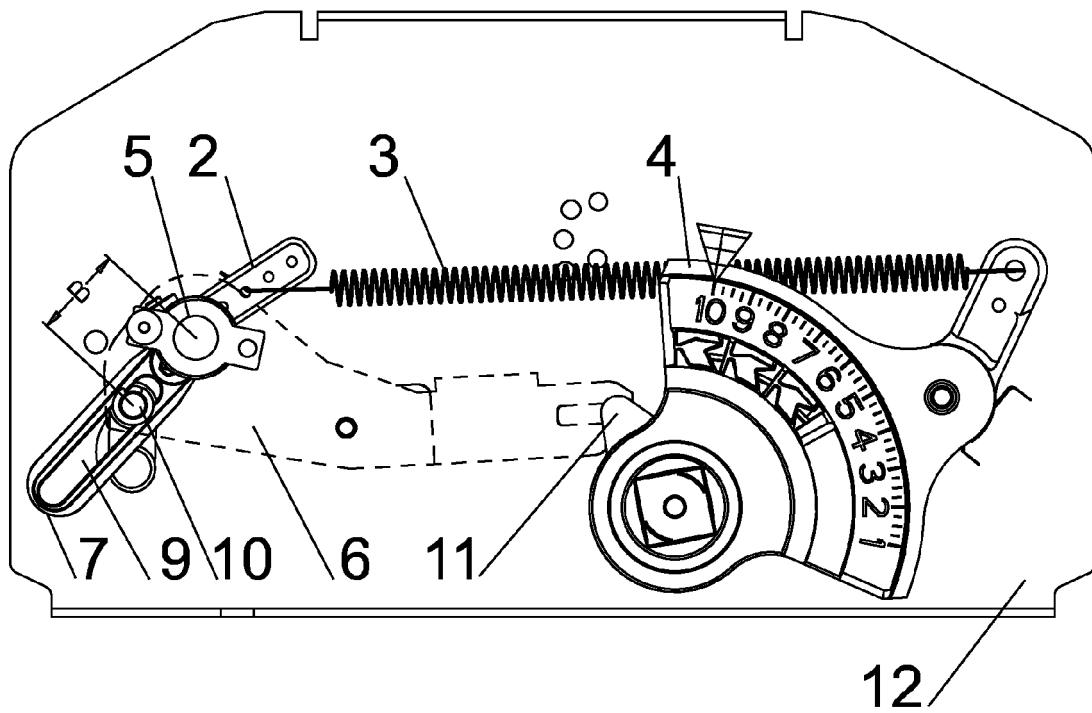


Fig. 9

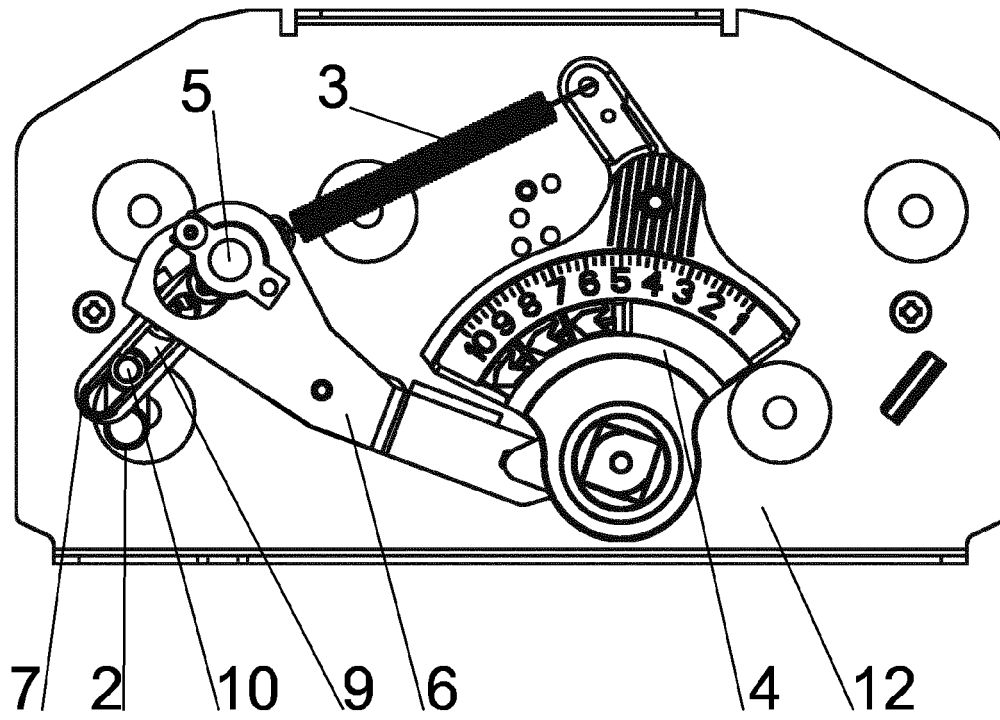


Fig. 10

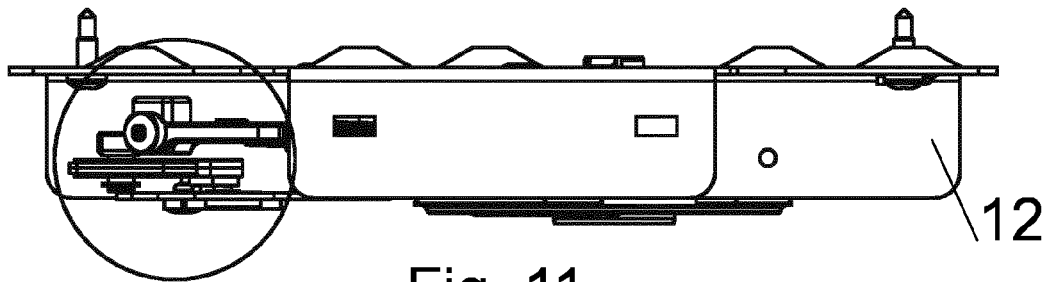


Fig. 11

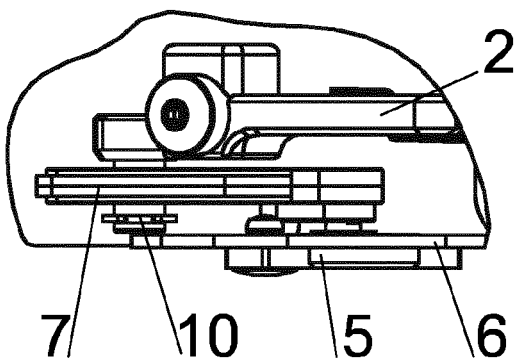


Fig. 12

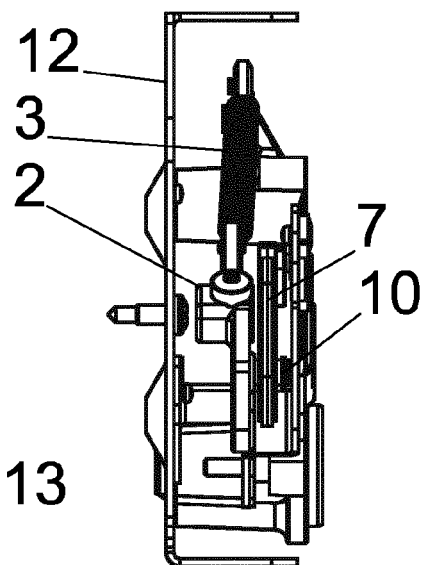


Fig. 13

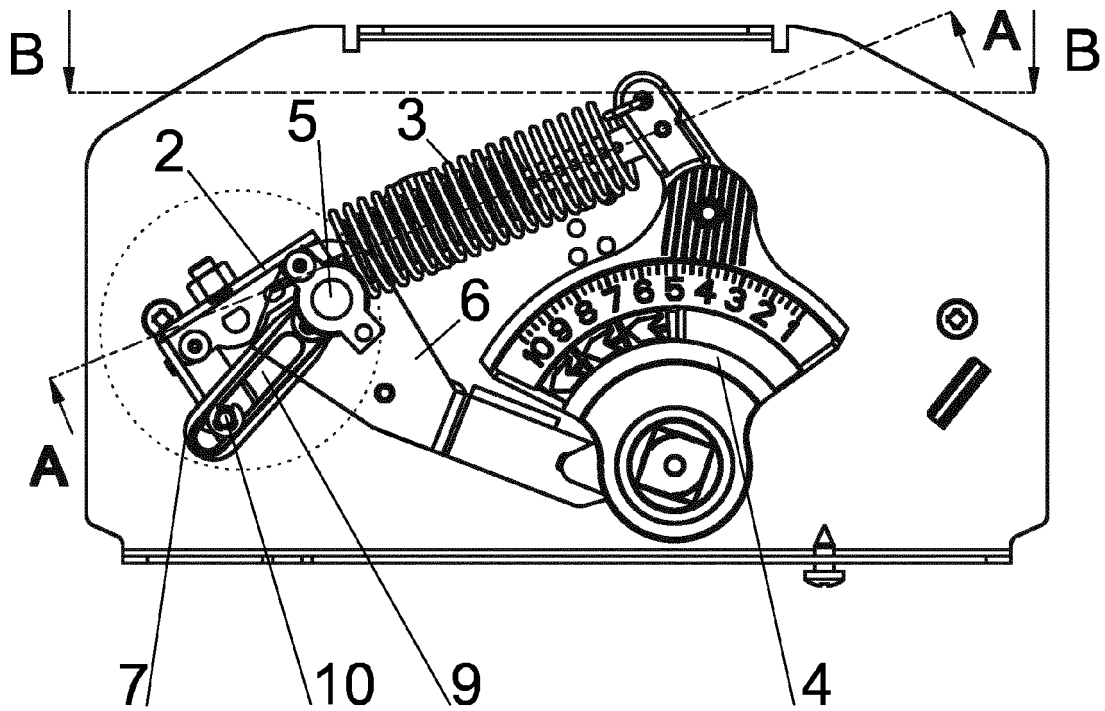


Fig. 14

B - B

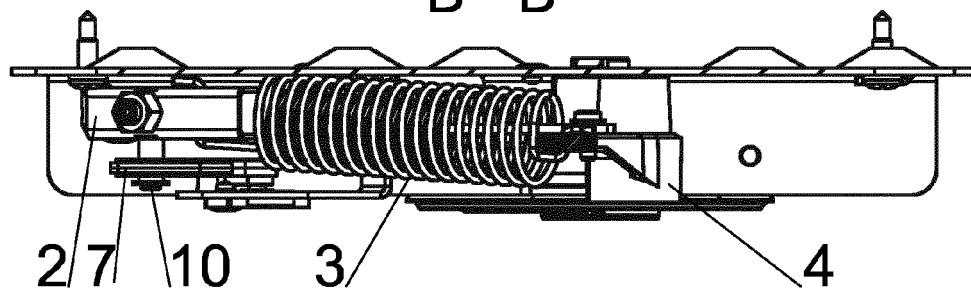


Fig. 15

A - A

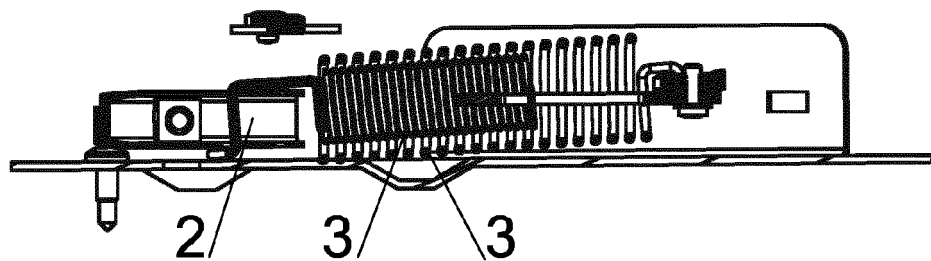
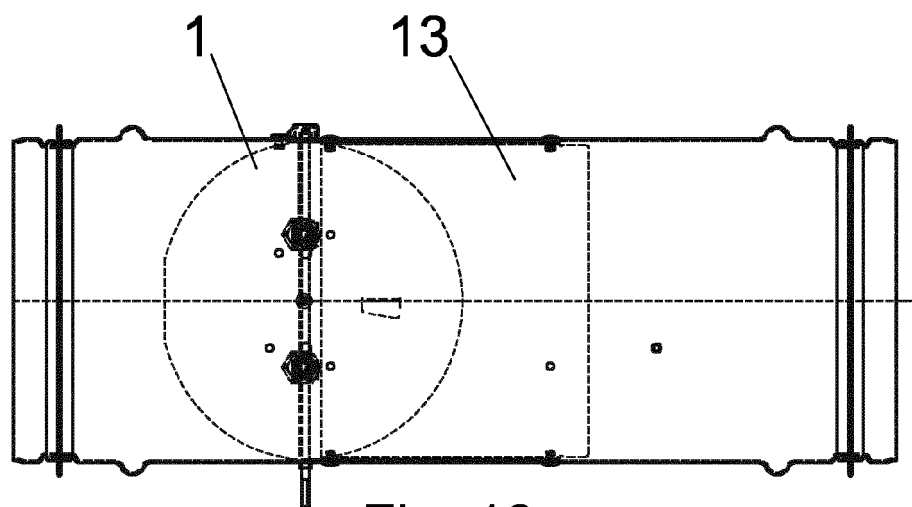
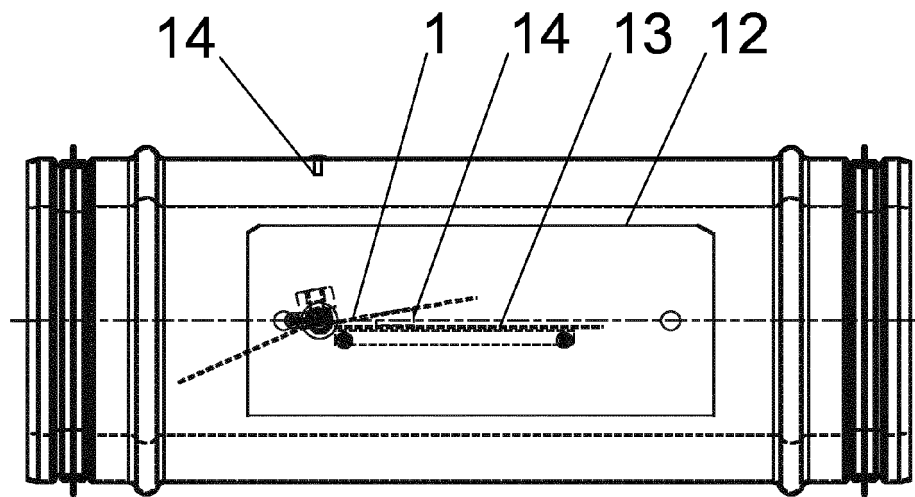
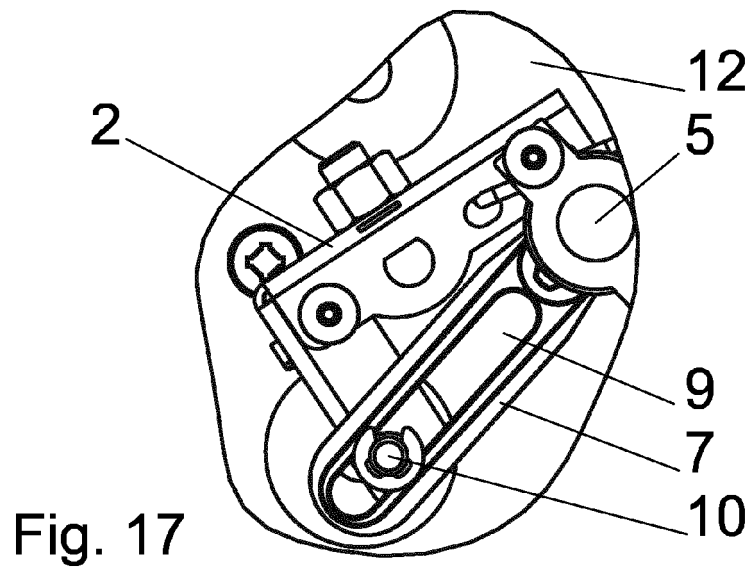


Fig. 16



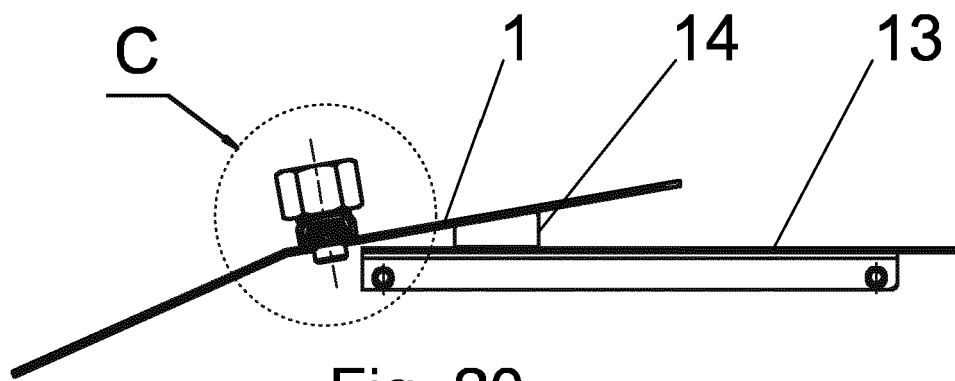


Fig. 20

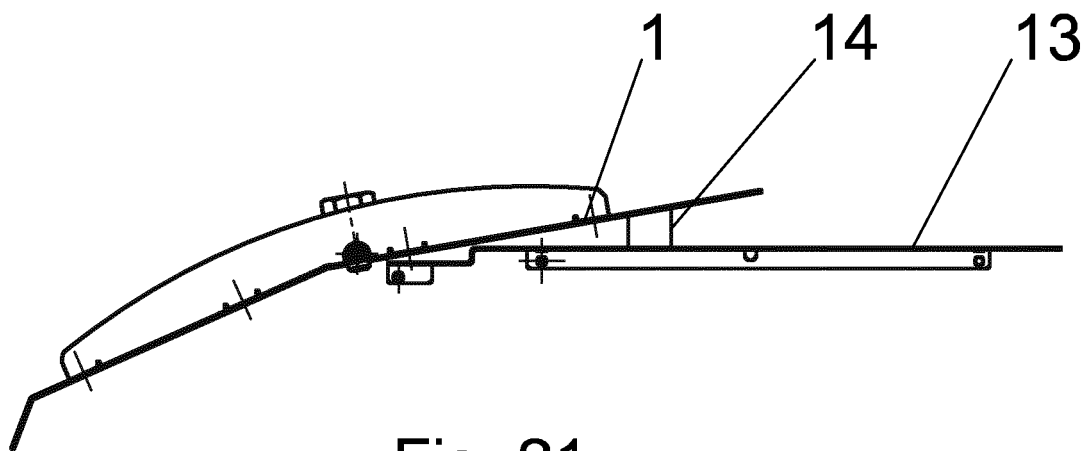


Fig. 21

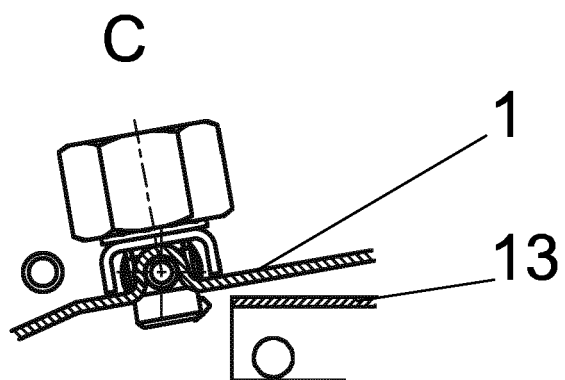


Fig. 22



EUROPEAN SEARCH REPORT

Application Number
EP 17 17 0939

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	CZ 11 646 U1 (IMOS ASEK [SK]) 12 December 2001 (2001-12-12) * page 3; figures 1-3; example 1 * -----	1,3, 6-13,15	INV. F24F13/14 F24F11/04 F16K31/00
X	GB 1 269 277 A (TROX GMBH GEB [DE]) 6 April 1972 (1972-04-06) * column 2, line 97 - column 3, line 2; figures 2,4 *	1,3, 6-13,15	F16K37/00 F16K1/22 F16K17/04
A	----- FR 1 313 310 A (NOUVEAUX ATELIERS LEBRUN) 28 December 1962 (1962-12-28) * the whole document *	1-15	
A	----- DE 102 22 673 C1 (WILDEBOER WERNER [DE]) 27 November 2003 (2003-11-27) * abstract; figures 1-5 * -----	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			F24F F16K
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 14 September 2017	Examiner Degen, Marcello
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 17 17 0939

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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14-09-2017

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