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[54] **PNEUMATIC HOLDING OR CLAMPING DEVICE**

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[51] **Int. Cl.**[2] **B25B 1/18;** F01B 15/02

[58] **Field of Search** ..... 269/23, 25, 27; 100/53, 100/269 R, 269 B; 91/209, 404, 416, 422; 425/151, 153, 154

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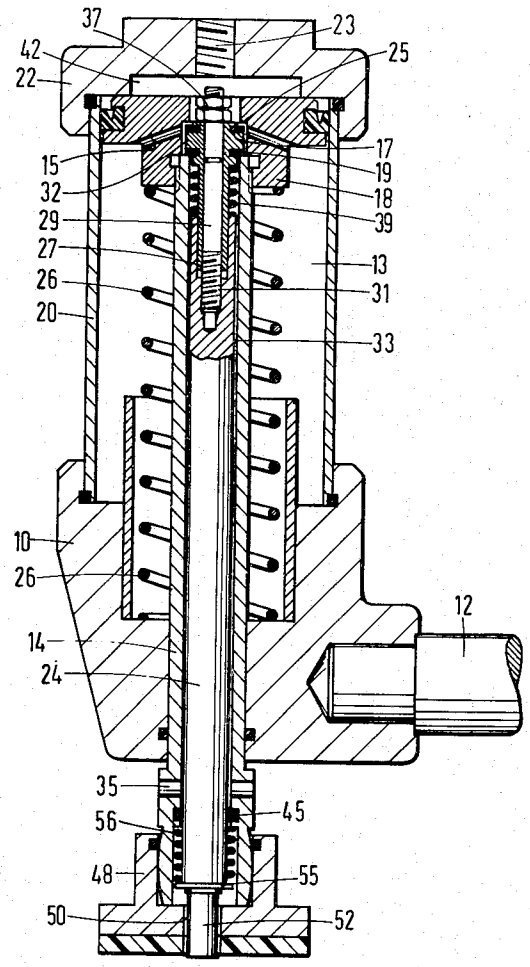
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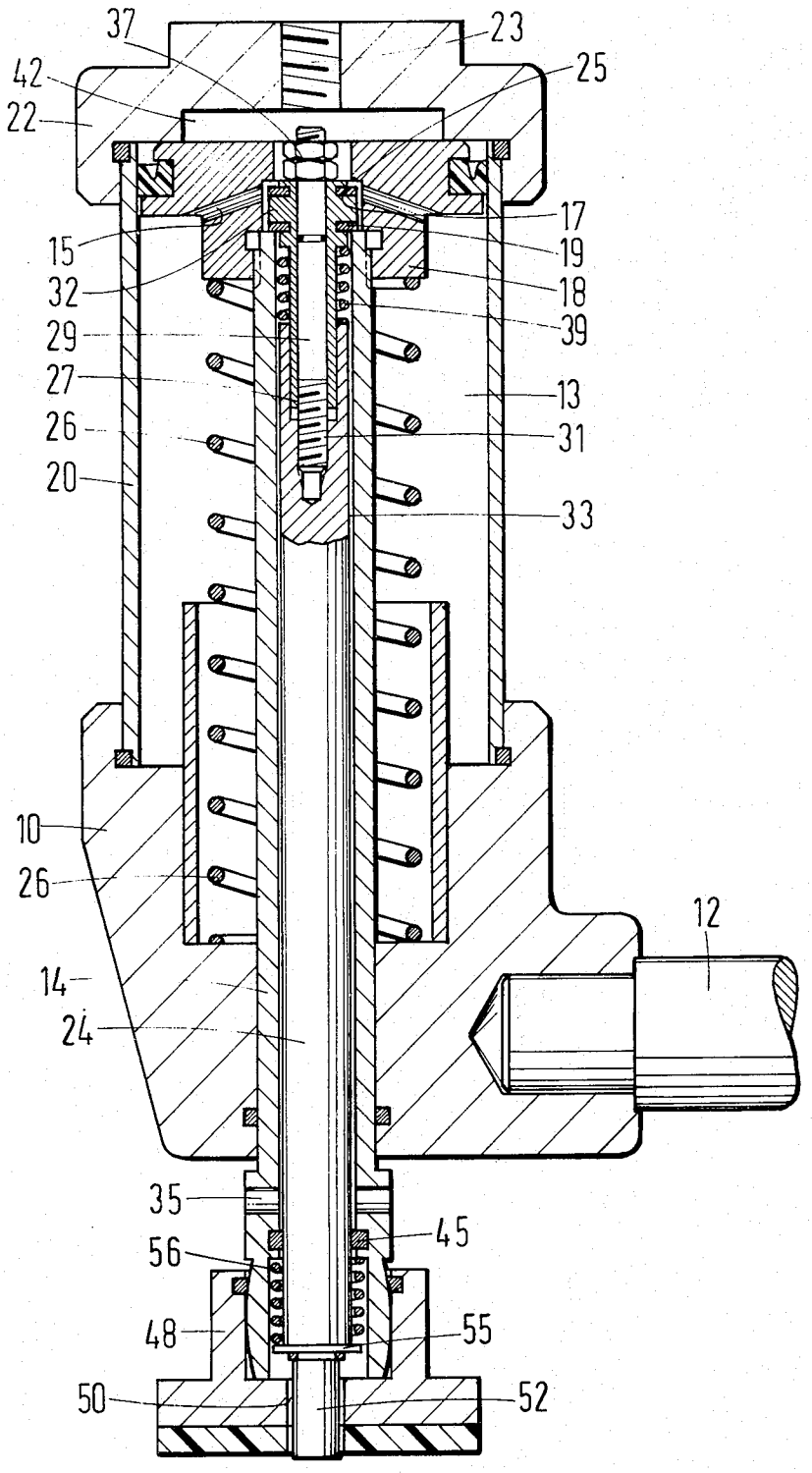
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[57] **ABSTRACT**

A holding or clamping device of the type comprising two pressure cylinders adapted to produce a first preliminary weak holding force and subsequently a greater holding force is provided with a sensor pin adapted to bring about a switch over from operation of the first cylinder to the second cylinder. The sensor pin is so loaded that it will only bring about the switching over when it strikes a hard object such as metal but is not actuated when it comes into contact with the human hand. The valve on actuation by the sensor pin closes the connection between the two chambers of the principal cylinder, which is constantly acted upon by pressure, and vents the rear side of the principal piston simultaneously.

7 Claims, 1 Drawing Figure




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PNEUMATIC HOLDING OR CLAMPING DEVICE

BACKGROUND OF INVENTION

The present invention relates to a pneumatic holding or clamping device.

REFERENCE TO RELATED APPLICATION

The present specification describes a further development of the invention described in the specification of my U.S. Pat. No. 3,811,667.

This previous patent specification refers to a pneumatic holding or clamping device for holding workpieces and comprising two holding cylinders with different diameters, of which the first cylinder with the smaller diameter is adapted to bring about a preliminary advancing movement, while the second or principal holding cylinder and which has a greater diameter than the first cylinder is adapted to produce a holding force at the end of the preliminary movement brought about by the first cylinder, the holding force of the second cylinder being greater than that of the first cylinder and an abutment sensor being provided adapted to open a valve for placing the second cylinder under pressure. The sensor, which is preferably constructed as a pin which slides in a pressing plate, ensures that the valve bringing about the switching over from the smaller advancing force to the greater holding force can only be actuated when a hard article or object is detected, for example a workpiece of metal, wood or the like, while the switching over to the full clamping force is prevented reliably when a soft object as for example the human hand is placed in the way of the sensor by mistake. The hand can therefore not be squashed by the high, dangerous holding pressure.

Since all parts which are necessary for the function of the cylinder are incorporated in the latter, it can be connected directly with a compressed air line just like any other conventional holding or clamping cylinder.

The valve between the first cylinder and the clamping cylinder is arranged in accordance with the construction described in the above-mentioned patent specification that on opening the valve the sensor ensures the transmission of the pressure within the first cylinder to the rear side of the main piston. The transfer is carried out in this case by the annular channel between the first cylinder which is constructed with two walls.

SUMMARY OF INVENTION

The present invention relates to a further development of the valve arrangement actuated by the sensor pin and one of its objects is to construct the holding or clamping device in a simpler manner mechanically while keeping to a satisfactory and rapid function.

This aim is to be attained in accordance with the invention in the case of a pneumatic holding or clamping device in accordance with the above-mentioned patent specification by adopting the feature that the valve actuated by the sensor pin closes, on actuation of the valve, the connection between the two chambers of the principal cylinder and vents the rear side of the principal piston so that the pressure acting constantly on the principal piston can become effective simultaneously with the venting of the rear side in order to close or apply the clamping device. The pressure medium in this case does not need to pass through any chokes or restrictions in the valve or the ducting and can immediately become effective when venting takes place, something which can easily be carried out via an annular channel between the first cylinder and a piston rod connected with the sensor.

In accordance with a further embodiment of the invention there is the provision of two or more abutment sensors which must be actuated jointly and simultaneously in order to cause the clamping device to become fully effective. By the use of suitable see-saw arrangements it is possible to take account this requirement, the see-saw or rocking lever means then being arranged to act upon the valve means.

DESCRIPTION OF PREFERRED EMBODIMENTS

In what follows an embodiment of the invention will be described with reference to the accompanying drawing. The single FIGURE of the drawing shows a sectional view of a pneumatic clamping device constructed in accordance with the invention.

The clamping or holding device comprises a front housing part **10,** which serves for attachment to a holding rod **12.** This housing part **10** guides a cylinder **14** so that the latter can move longitudinally. The cylinder **14** forms a hollow piston rod for the principal or main holding piston **18,** which runs in a principal holding or clamping cylinder **20** connected with the housing **10.** The cylinder **20** is connected with a cylinder end plate or lid **22.** The principal holding piston **18** engages a return spring **26,** constructed in the form of a compression helical spring, on the front part **10** of the housing. The rear side of the principal holding piston **18** is continuously put under pressure via the axial inlet opening **23.** Within an annual hole of the principal holding piston **18** a valve body **32** can move axially and it has a rear sealing disc **17** and a front sealing disc **19.** The rear sealing disc **17** cooperates with a valve annular seat **25** of the principal holding piston **18** and the front seal **19** cooperates with the rear end of the first cylinder **14.** The valve body **32** is provided with a guide sleeve **27,** which can be moved axially on a pin **29.** This pin **29** is provided with a screw thread and screwed into an axial hole **31** in a push rod **24.** The rod **24** is guided for sliding movement in the cylinder **14** leaving an annular gap **33.** At the top end this annular gap **33** is terminated by a seal **45** between the cylinder **14** and the piston **24.** Underneath there is the annular gap **33** which is connected via radial venting holes **35** with the atmosphere. The valve body **32** is supported by a nut **37** screwed onto the pin **29** and between the valve body **32** and the rear end annular face of the piston **24** there is a helical compression spring **39,** which biases the valve body **32** to the rear. The push rod **24** carries a sensor pin **52,** which can be moved axially in a hole **50** of a pressure plate **48** and the pressure plate is mounted on the front part of the cylinder **14** so as to be able to perform a limited swinging movement. A helical compression spring **56,** which rests on an annular end face of the cylinder **14** and, respectively, on a ring **55** mounted on the piston, presses the sensor pin **52** into its front terminal position, which is defined by the sealing ring **19** on the rear annular end face of the cylinder **14.** In this respect the sensor pin extends by a slight amount beyond the front plane of the pressure plate **48.**

The function of the holding or clamping device is as follows: The compressed air flows through the hole **23** at the upper cylinder end plate **22** into the rear cylinder chamber **42.** In the rest position represented in the drawing the valve disc of valve body **32** is raised from its seat **25** and the valve body **32** has the valve disc **19**

lying against its seat in a sealing manner. Accordingly via the radial holes **15** within the principal holding or clamping piston **18** the pressure medium can flow from the rear side of the piston towards its front side and charge the front cylinder chamber **13** so that in front of and behind the piston the same pressure is established. As a result in the cylinder **20** a thrust force is built up in accordance with the cross-section of the piston rod **14,** the rod **14** being so dimensioned that it overcomes the resistance of the compression spring **26** and slowly advances the pressure plate **48** with a slight degree of force. When the sensor pin **52** has run up against hard material, the valve body **32** is displaced axially to the rear so that the sealing ring **19** is raised and the sealing ring **17** comes into engagement with its seat **25.** As a result the air path between the front and the rear parts of the principal cylinder chamber is blocked and the pressure supplied via the hole **23** becomes fully effective on the principal holding piston **18** so that the latter can move suddenly and with a large degree of force forward because the front cylinder chamber can be vented via the valve opening between the ring **19** and the annular end face of the cylinder **14,** the annular gap **33** and the radial holes **35** suddenly. Owing to the venting of the front cylinder chamber the principal holding piston **18** reaches its full thrust force. The compression spring **39** arranged between the valve body **32** and the sensor pin **52** extended via the rod **24** brings about a resilient yielding of the valve body so that even after wear of the seals on the valve plunger reliable closing of the hole or bore on the piston is ensured.

The compression spring **56** on the underside of the sensor pin **52** has the purpose of holding the vavle body **32** reliably on its seat at the end of the cylinder **14** and to cause the sensor pin **52** to extend somewhat beyond the pressure plate **48.** The diameter of the valve plate of the valve body **32** is so selected that the valve body is pressed before the switching over operation sufficiently forcibly against the seat at the end of the cylinder **14** and it requires something more than a gentle force to press in the sensor pin. The diameter of the valve plate accordingly determines the counter-pressure, which is necessary for actuating the sensor pin.

I claim:

1. A pneumatic holding device for workpieces, comprising:

a first holding cylinder of narrower cross-section; a first chamber defined in and by said first cylinder; a vent from said first chamber;

a second cylinder of larger cross-section; a first piston sealingly located in and movable along and through said second cylinder; said first piston dividing said second cylinder into second and third chambers;

a first conduit across said first piston and communicating between said first and said second chambers; a second conduit across said first piston and communicating between said second and said third chambers;

a fluid inlet to said third chamber;

a valve movable for selectively opening one of said first and second conduits while closing the other of said first and second conduits, and vice versa;

an abutment sensor extending out of said pneumatic holding device and being connected with said valve for causing the aforesaid movement thereof, in a manner such that application of pressure to said abutment sensor shifts said valve to close said second conduit.

2. The pneumatic holding device of claim **1,** further comprising a second piston in and extending along said first cylinder, and having a cross-section less than said narrower cross-section of said first cylinder, thereby defining said first chamber between said first cylinder and said second piston; said abutment sensor being connected with said second piston for moving same; said valve communicating with said second piston thereby to be moved by movement of said second piston.

3. The pneumatic holding device of claim **2,** wherein said first cylinder is positioned within said second cylinder.

4. The pneumatic holding device of claim **2,** wherein said valve comprises a valve body and a valve chamber, said valve chamber being formed in said first piston; said valve body being movable in said valve chamber;

a first valve seat in said valve chamber; said first cylinder extending into and terminating at an end in said first piston; said first valve seat being near said first cylinder end;

a second valve seat in said valve chamber, located opposite said first valve seat, and formed in said first piston; said valve closing said second conduit when said valve body is against said second valve seat and opening said second conduit when said valve body is against said first valve seat.

5. The pneumatic holding device of claim **4,** further comprising a compression spring between said valve body and said second piston for forcing them in opposite directions.

6. The pneumatic hoding device of claim **5,** further comprising a compression spring normally biasing said first piston in a direction away from said abutment sensor.

7. The pneumatic holding device of claim **6,** further comprising a pressure plate connected with and movable with said first piston; said abutment sensor projecting through and being freely movable with respect to said pressure plate, such that application of pressure to said abutment sensor moves same inward of said pressure plate and closes said valve body against said second seat, thereby venting said second chamber through said first chamber and permitting build up of pressure in said third chamber, thereby to shift said first piston through said second cylinder.

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