Aug. 5, 1958 J. LOXHAM ET AL 2,845,791

PNEUMATIC GAUGES

Filed Oct. 27, 1955 2 Sheets-Sheet 1

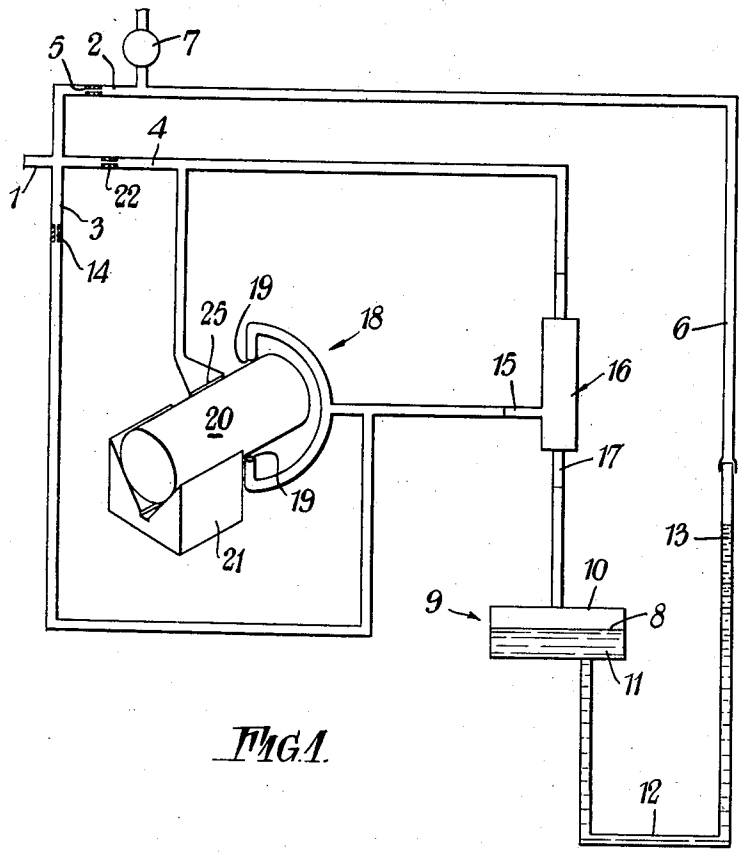

FIG. 1.

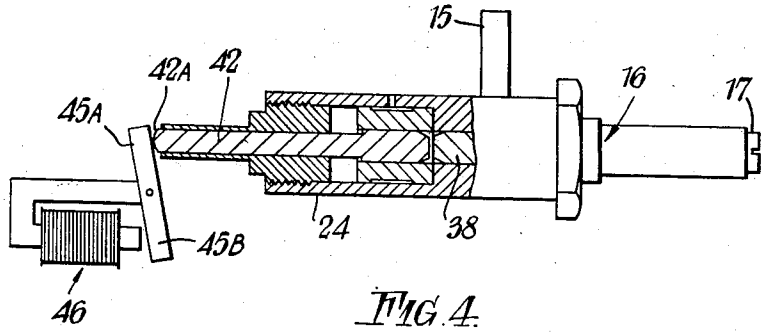

FIG. 4.

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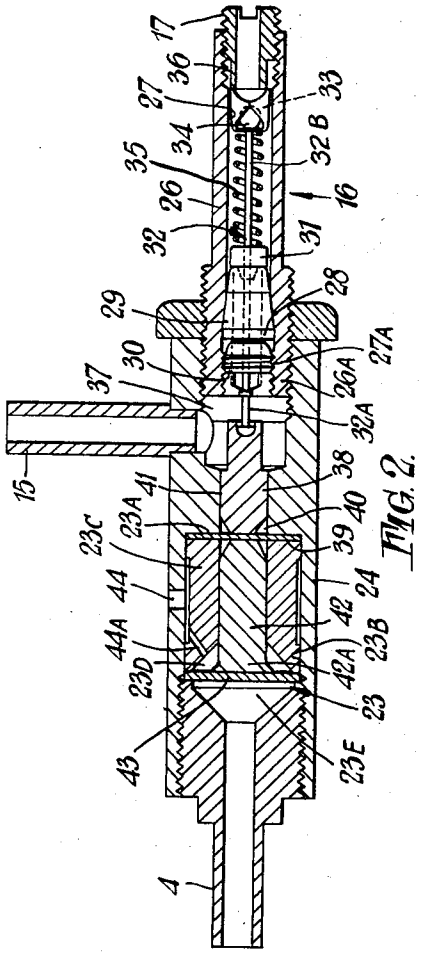

FIG. 2.

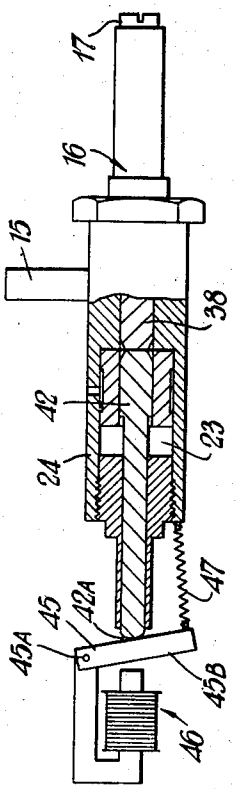

FIG. 3.

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PNEUMATIC GAUGES

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Claims priority, application Great Britain December 30, 1954

4 Claims. (Cl. 73—37.5)

This invention relates to pneumatic gauges.

According to the present invention there is provided a pneumatic gauge comprising a gauging jet for co-operating with the workpiece to be gauged, a pressure indicating device, an air supply pipe leading through a constriction to the jet, a conduit between said device and the part of said pipe that is between the constriction and the jet, a valve in the conduit, and means controlling the valve so that when a workpiece is located in the gauging position the valve is open and when there is no workpiece in the gauging position the valve is closed, the arrangement being such that during gauging of a workpiece the indication given by said device is indicative of the dimension being gauged and such that when the workpiece is removed from the gauging position the valve is closed before the leakage of the air from the jet changes as the result of removal of the workpiece from the gauging position, whereby said device maintains said indication after the workpiece has been removed from the gauging position.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made to the accompanying drawings, in which:

Figure 1 is a diagrammatic layout of a pneumatic gauge,

Figure 2 is a cross-section of a retaining valve employed in the gauge of Figure 1, and

Figures 3 and 4 are partly cross-sectioned views of alternative forms of retaining valve.

The pneumatic gauge now to be described is an improvement on the gauge described in our British patent specification No. 724,205, the improvement consisting in the addition of means for retaining the indication in the manometer tube, after a workpiece that has been gauged is removed from the gauging position.

In the present apparatus an air supply pipe **1** divides into three branches **2, 3, 4**. The branch **2** leads through a constriction **5** to the upper end of the manometer tube **6**, there being a leak-off valve **7** that is adjustable to permit controlled leakage of air from the part of the branch **2** that is between the constriction **5** and the top of the tube **6**. A horizontally disposed flexible diaphragm **8** divides a flat box **9** into upper and lower compartments **10, 11**. The lower compartment **11** communicates with the tube **6**. The lower compartment **11**, the lower part of the tube **6** and the conduit **12** connecting the tube **6** to the lower compartment **11** contain a liquid **13**, e. g. water.

The branch **3** leads through a constriction **14** to the inlet **15** of a retaining valve **16**. The outlet **17** of the retaining valve communicates with the upper compartment **10** of said box **9**. That part of the branch **3** that is between the constriction **14** and the inlet **15** to the retaining valve **16** communicates with a gauging caliper **18** having a jet or jets **19** for co-operating with the workpiece **20**. In the present instance the workpiece **20** is a cylinder that is supported in the gauging position by a

V-block **21**. The caliper **18** has two jets **19** which are arranged for co-operating with the workpiece **20** at diametrally opposed locations.

The retaining valve **16** is such that when opened the inlet **15** thereto communicates with the outlet **17**, and when closed the inlet and outlet do not communicate, escape of air from the outlet being prevented. The retaining valve **16** may be electrically, mechanically, hydraulically or pneumatically operated. In the present instance a pneumatically operated arrangement will be described. To this end the branch **4** leads through a constriction **22** to one end of a cylinder **23** (Figure 2) in a mounting **24** that carries the retaining valve **16**. That part of the branch **4** that is between the constriction **22** and the cylinder **23** communicates with a monitoring jet **25**. The monitoring jet **25** is elongated along the axis of the workpiece **20** so that its length is two or three times greater than the diameter of the gauging jets **19**. The gauging jets **19** are located in a plane that is perpendicular to the axis of the workpiece and which approximately bisects the monitoring jet **25**.

The retaining valve **16** is a well-known Schrader tire valve. This valve has a cylindrical casing **26** which has a bore **27** that is slightly widened towards the end **27A**. A hollow frusto-conical seating member **28** having a resilient sealing material **29** on the exterior thereof is inserted in the wider end **27A** of the bore **27** until it binds against the wall of the bore **27** where the bore begins to narrow. The seating member **28** is held in this position by a collar **30** screwed into the casing **26**. A valve member in the form of a cup **31** is secured centrally on a pin **32**, one end **32A** of which is passed through the seating member **28** and the collar **30** to project beyond the wider end of the casing **26**. The mouth of the cup **31** faces the periphery of the narrower end of the seating member **28**, this periphery forming the seat of the valve and co-operating with a rubber washer (not shown) contained in the cup **31**. The other end **32B** of the pin **32** is passed freely through a retaining member **33**, which latter is held on the pin **32** by a head **34** on the latter. A coiled spring **35** around the pin **32** is located between the retaining member **33** and the bottom of the cup **31**. A collar **36** is screwed into the narrower end of the casing **26** to encounter the retaining member **33** and thereby to impart a valve closing force on the cup **31**, through the intermediary of the spring **35**. The force required to open the valve is, of course, determined by the extent to which the collar **36** is screwed into said narrower end of the casing **26**. This narrower end of the casing forms the outlet to the retaining valve.

The end **26A** of the casing **26** is secured in the mouth of a recess **37** formed in said mounting **24**. The inlet **15** of the retaining valve communicates with the recess **37**. The end **32A** of the pin **32** abuts against one end of a push rod **38** that is slidably carried in the mounting **24**, the other end of the push rod **38** being in contact with one side of a flexible membrane **39** that is secured against the wall **23A** of the cylinder **23**. The membrane **39** covers the opening **40** to the bore **41** in the mounting **24**, in which bore **41** the push rod **38** is located. One end of a further push rod **42**, located in the cylinder **23** and supported by a collar **23C**, co-operates with the other side of the membrane **39** at a location immediately opposite the end of the push rod **38**. The other end **42A** of the push rod **42** which end is enlarged and located in a recess **23D** in the collar **23C** contacts the central part of a diaphragm **43** the periphery of which is secured to the curved wall **23B** of the cylinder **23**. The recess **23D** is vented to atmosphere by ports **44** and **44A**.

The apparatus described above operates as follows. Before a workpiece is placed on the V-block **21** air escapes freely from the monitoring jet **25** and hence the

pressure applied to the end 23E of the cylinder 23 is low and the spring 35 maintains the valve 16 in the closed condition. When a workpiece 20 is placed on the V-block 21, the monitoring jet 25 is eventually fully masked by the workpiece 20. Since, however, the monitoring jet 25 extends beyond the gauging jets 19 in both directions, the monitoring jet 25 will not be masked until the workpiece 20 is correctly co-operating with the gauging jets 19 for gauging purposes. Leakage of air from the gauging jets 19 takes place in accordance with the clearance between these jets 19 and the workpiece 20, and hence the leakage of air from these jets and consequently the pressure applied to the inlet 15 is an indication of the diameter of the workpiece. This gauging aspect of the present apparatus is described in greater detail in the aforementioned patent specification No. 724,205. When the monitoring jet 25 has been masked by the workpiece 20 (i. e. after the correct gauging pressure has been applied to the inlet 15) the pressure on the downstream side of the constriction 22 rises, and the diaphragm 43 deflects against the action of the coiled spring 35, the movement of the diaphragm 43 being transmitted to the end 32A of the pin 32 through the intermediary of the two push rods 42, 38, whereby the retaining valve 16 opens and the inlet 15 communicates with the outlet 17 by way of the recess 37, the collar 30, the interior of the frustoconical member 28, the annular passage between the periphery of the cup 31 and the bore of the casing 26, the gap between the pin 32 and the member 33, and the collar 36. The gauging pressure is therefore applied to the upper compartment 10 and the level of the liquid 13 assumes a position idicative of the diameter of the workpiece 20 being gauged. When the workpiece 20 is removed from the gauging position and immediately the monitoring jet 25 commences to be unmasked, the pressure on the downstream side of the constriction 22 drops and the retaining valve 16 closes so that escape of air from the upper compartment 10 is prevented. This takes place before any change in pressure at the inlet 15 of the retaining valve 16 and hence the liquid is maintained at said level even though the workpiece 20 is removed from the V-block 21. The liquid 13 will in fact remain at the same level until another workpiece 20 is placed in the gauging position and masks the monitoring jet 25.

In an alternative method of operating the Schrader valve 16 the push rod 42 (Figure 3) is extended through the cylinder 23 and projects from the mounting 24, the projecting part 42A co-operating with a pivoted lever 45 that forms the armature of an electro-magnet 46. The lever 45 is pivoted at the end 45A and the projecting part 42A co-operates with central part of the lever 45, there being a spring 47 connected as between the end 45B of the lever 45 and the mounting 24 to maintain the lever 45 in contact with the push rod 42. The electro-magnet 46 is arranged to be energised when there is no workpiece 20 in the gauging position. Such energisation moves the lever 45 against the action of the spring 47, and the coiled spring 35 in the retaining valve 16 maintains this valve in the closed condition. The electro-magnet 46 is de-energised when a workpiece 20 is placed in the gauging position and hence the valve 16 is opened. In a slightly modified form (Figure 4) the lever 45 may be pivoted centrally, the projecting part 42A of the push

rod 42 co-operating with the end 45A of the lever 45 and the end 45B of the lever being acted upon by the electro-magnet 46. In this case the electro-magnet 46 is un-energised when there is no workpiece 20 in the gauging position, the electro-magnet 46 being energised and the valve 16 thereby opened when there is a workpiece 20 in the gauging position.

We claim:

1. A pneumatic gauge for checking a dimension of a workpiece, the gauge having a gauging station and comprising a pressure indicating device including a visible indicator for indicating the pressure applied to the device, a gauging jet at the gauging station and providing an outflow which is varied by the workpiece being checked, an air supply pipe leading to said jet, a constriction in said pipe, a normally closed valve having an inlet and an outlet and including control means at least in part between and controlling the coupling of said inlet and said outlet, a first conduit connecting said inlet with a part of said pipe between the constriction and the jet, a second conduit connecting said outlet to said device, sensing means at the gauging station for determining the presence of a workpiece at the gauging station, means connecting said sensing means to said control means to open said valve with a workpiece placed at the gauging station whereby a gauging pressure is applied to said device and to close the valve with the workpiece removed from the gauging station whereby the position assumed by said visible indicator during gauging is retained until another workpiece is placed at the gauging station.

2. A gauge according to claim 1, wherein the sensing means includes means forming a monitoring jet for co-operation with the workpiece, a branch pipe connected between said monitoring jet and the part of the air supply pipe on the upstream side of said constriction, and a further constriction in said branch pipe, and wherein the connecting means includes a pressure-responsive means for operating said member, and a conduit connected between said pressure-responsive means and the part of said branch pipe on the downstream side of said further constriction.

3. A gauge according to claim 2, adapted for gauging the diameter of a cylindrical workpiece, wherein the monitoring jet is elongated in the direction of the axis of the workpiece to be gauged and extends in both directions from a plane perpendicular to said axis and passing through said gauging jet.

4. A gauge according to claim 3, wherein there is a further gauging jet, the two gauging jets being connected together in parallel, both jets being located in said plane and being disposed for co-operating with a workpiece at diametrically opposed locations.

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