Aug. 31, 1965 J. M. McGRATH ETAL 3,203,240

FLOWMETER

Filed Feb. 1, 1962

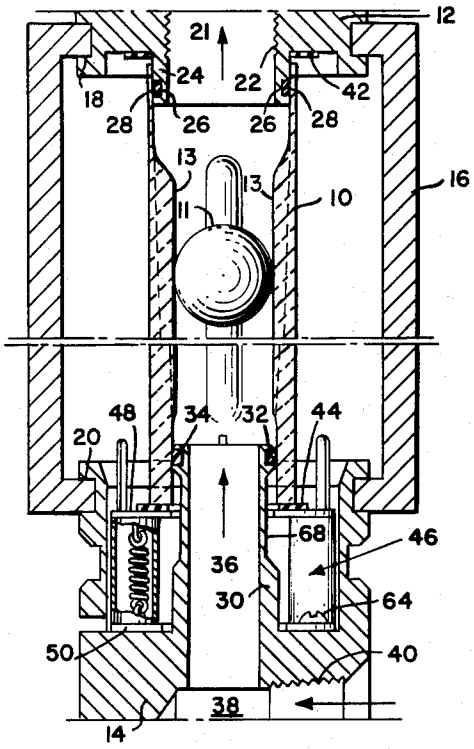



FIG. 1.

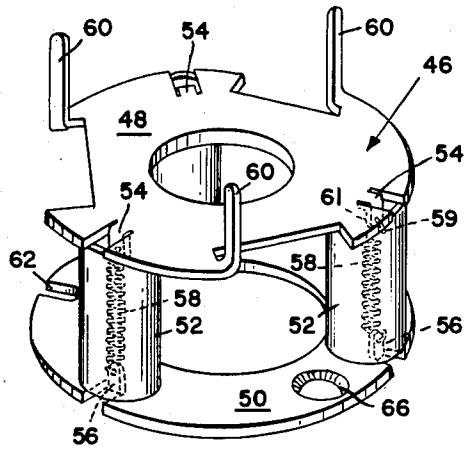



FIG. 2.

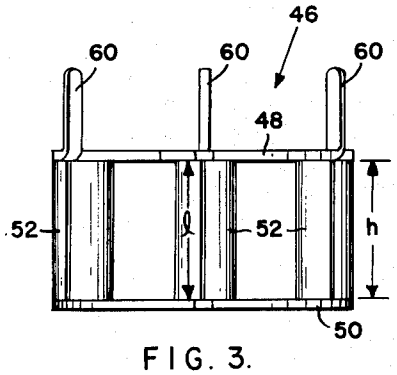



FIG. 3.

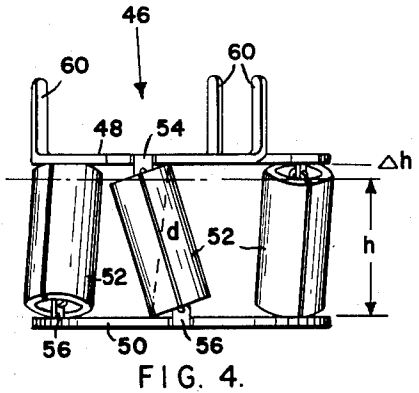



FIG. 4.

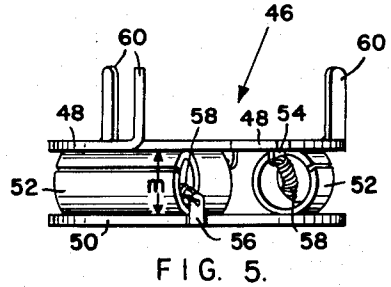



FIG. 5.

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United States Patent Office 3,203,240 Patented Aug. 31, 1965



3,203,240

# FLOWMETER

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Filed Feb. 1, 1962, Ser. No. 170,367
7 Claims. (Cl. 73—209)

This invention relates to variable area flowmeters and more particularly relates to a positive action, quick-release assembly whereby flow tubes may be interchanged with others of the same or different size, or removed for cleaning, while, at the same time, eliminating the danger of accidental release of a flow tube.

Heretofore, such flow tubes have been maintained in position by means of a compression spring which biases the tube against one end of the flowmeter mounting structure. However, such compression type springs have been found to be unreliable in that they may allow the tubes to become accidentally disengaged from their mountings with the consequent release of the fluid being metered. Such disengagement sometimes results merely from unequal pressures within the tube due to the variable area cross-section of the metering portion thereof or of the ends thereof which causes the tube to shift axially and compress the spring thereby allowing the tube to become unseated from its normal operating position. Sometimes, also, a person desiring to make a reading may turn the tube for better visibility and in doing so may release it.

One object of the present invention is to provide a variable area flowmeter wherein the flow tube may be easily removed for replacement by another tube while at the same time providing a positive securing means for the tube which will not allow its accidental removal.

Another object of the present invention is to provide a new and improved locking and releasing assembly for securing a tube in position. A further object of the present invention is to provide such a flowmeter locking and releasing assembly which is positioned wholly externally of the flow tube so that no portion of the assembly is subject to corrosion by the metered fluid or deposit therein of solid or sticky material.

In brief, the above objects are achieved by provision of a collapsible support and locking assembly which essentially comprises two spaced discs normally maintained in their spaced apart relationship by means of rigid thrust-resisting legs interposed therebetween, but which can be moved toward one another upon rotation of one disc relative to the other disc due to the collapsibility of the legs.

The attainment of the foregoing and other objects of the invention, particularly relating to details of construction and operation, will become apparent from the following description read in conjunction with the accompanying drawing, in which:

FIGURE 1 is a side elevation, partly in section, showing the flowmeter tube in its locked position in its mounting;

FIGURE 2 is an enlarged, perspective view of the locking assembly per se;

FIGURE 3 is a side elevation of the locking assembly in its locked position;

FIGURE 4 is a side elevation of the locking assembly in an intermediate position of collapse; and



FIGURE 5 is a side elevation of the locking assembly in its fully collapsed position.

Referring first to FIGURE 1, there is shown a variable cross-sectional area flow tube **10** which may be formed of glass, plastic, metal, or the like and contains a float, typified by ball **11**, guided for free vertical movement by ribs **13**. Tube **10** is positioned between outlet mounting element **12** and inlet mounting element **14** which are rigidly spaced relatively to one another as, for example, by means of frame members **16** positioned in suitable grooves **18** and **20**. Element **12** is shown as provided with a central bore **21** having a threaded portion **22** adapted to receive the threaded portion of an outlet pipe (not shown). Element **12** further includes an integral, depending tubular portion **24** having an external annular groove **26** wherein O-ring seal **28** is retained in sealing relationship to the internal bore of tube **10**. Similarly, element **14** includes an upstanding, integral tubular portion **30** having an O-ring seal **32** positioned in external annular groove **34**, seal **32** being in engagement with the internal surface of tube **10** thereby providing an effective seal at the lower end of the tube. Tubular portion **30** provides a vertical inlet flow path which leads into tube **10** from lateral bore **38**, the latter being provided with threads **40** adapted to receive the threaded portion of an inlet pipe (not shown). Finally, FIGURE 1 shows flow tube **10** supported by the flow tube locking assembly **46** which normally maintains tube **10** in position between resilient washers **42** and **44** provided for the purpose of cushioning the ends of tube **10** from contact with the inlet and outlet elements.

The locking assembly **46** comprises an upper annular disc **48** and a lower annular disc **50** which are maintained in axially spaced relationship by means of rigid, cylindrical support legs **52**. Discs **48** and **50** include integral apertured tabs **54** and **56**, respectively, to which the opposite ends of tension springs **58** are secured as by means of hook ends **59**, engaging the apertures **61**. Springs **58** normally maintain discs **48** and **50** in abutment with the ends of the legs **52** which, in turn, normally maintain the discs in their rigidly spaced relationship as shown in FIGURES 1 through 3. Upper disc **48** further includes a plurality of integral handles **60**, the purpose of which will be more fully set forth hereinafter, whereas, lower disc **50** is provided with a slot **62** and a countersunk aperture **66** for the reception of screws **64** which secure disc **50** to inlet element **14** as shown in FIGURE 1.

At this point it should be noted that, since springs **58** pass through the internal bores of cylinders **52** and are secured to the ends of tabs **54** and **56** within the cylinders, it has been found advantageous to fabricate legs **52** of sheet metal so that springs **58** may be secured to tabs **54** and **56** followed by the formation of the sheet metal legs around the springs after the discs and springs are assembled.

Referring now to FIGURE 4, it will be seen that, upon rotation of disc **48** relative to disc **50**, legs **52** are caused to tumble pivotally about their diagonally opposite edges so that the normal spacing $h$ between plates **48** and **50** must be increased by an amount represented by $\Delta h$ due to the fact that the diagonal $d$ between opposite edges of support legs **52** is greater than their axial length $l$. However, upon continued rotation of disc **48** relative to disc **50**, it will be apparent that disc **48** may move downwardly to the collapsed position of the assembly as

shown in FIGURE 5 wherein the spacing between discs 48 and 50 is determined by the diameter *m* of support legs 52 which is much less than their axial length, the difference being in excess of the downward movement necessary to cause the flow tube to clear the tubular portion 24 of the outlet element 12 when moved downwardly.

From the foregoing description, it will be apparent that the removal of flow tube 10 and the insertion of a different sized flow tube, or a replacement tube for a broken one, may be easily accomplished by merely grasping one or more of vertically extending handles 60 and rotating disc 48 relative to disc 50, the latter being rigidly secured to inlet element 14 by means of screws 64. As previously set forth, upon initial rotation of disc 48 relative to disc 50, disc 48 must move upwardly as viewed in FIGURE 1 by the amount designated $\Delta h$ which is permitted by the slight clearance provided between the upper end of tube 10 and washer 42. Upon continued rotation of disc 48, the locking assembly will assume its collapsed position as shown in FIGURE 5, whereupon, flow tube 10 may be moved downwardly to such an extent that the upper end of tube 10 will clear the lower end of tubular portion 24 of outlet element 12. Then, tube 10 may be rocked laterally due to the resilience of the O-ring 32 and lifted out of engagement with tubular portion 30. It will be noted that the external surface of tubular portion 30 is provided with an axially extending groove 68 whereby the lower end of tube 10 may be laterally rocked without engaging the external surface of tubular portion 30.

Following the removal of tube 10 according to the above-described procedure, it will be apparent that a new tube may be inserted in the reverse manner, whereupon springs 58, which are elongated when the assembly is collapsed, will cause disc 48 to rotate in the reverse direction, thereby returning the locking assembly to its locked position as shown in FIGURES 1 through 3 wherein any accidental displacement of tube 10 is positively prevented because of the fact that disc 48 must move upwardly by the amount $\Delta h$, thus elongating the springs, before the locking assembly 46 can assume its collapsed position. Thus, it will be apparent that tube 10 cannot accidentally become disengaged due to line pressure, vacuum, or even if someone should accidentally twist the tube or intentionally do so to improve visibility of reading. It will therefore be apparent that the invention provides a positive locking assembly whereby the flow tube will be maintained in its normal position without danger of accidental removal while at the same time provides a readily releasable locking assembly whereby the tube may be quickly and easily removed or replaced.

It will be evident that various modifications and/or alterations may be made without departing from the invention as defined in the appended claims.

What is claimed is:

1. A flowmeter comprising support means including inlet and outlet elements, a flow tube mounted between said inlet and said outlet elements, and a collapsible locking assembly for removably locking said tube in operating position including a platform member, rigid spacing means located between said platform member and one of said elements, means biasing said platform member into engagement with said spacing means, said spacing means having major and minor transverse dimensions, and means for moving said spacing means from a first position wherein said platform member and said one element are separated by said major dimensions to a second position wherein said platform member and said one element are separated by said minor dimension.

2. A flowmeter comprising support means including inlet and outlet elements, a flow tube mounted between said inlet and said outlet elements, and a collapsible locking assembly for removably locking said tube in operating position including first and second platform members, rigid spacing means located between said first and second platform members, means biasing each of said platform members into engagement with said spacing means, said spacing means having major and minor transverse dimensions, and means for moving said spacing means from a first position wherein said platform members are separated by said major dimension to a second position wherein said platform members are separated by said minor dimension, said locking assembly being positioned such that one of said platform members abuts a portion of said flow tube and the other of said platform members abuts one of said elements.

3. A flowmeter comprising support means including inlet and outlet elements, a flow tube mounted between said inlet and outlet elements, and a collapsible locking assembly for removably locking said tube in operating position including first and second platform members, rigid spacing means located between said first and second platform members, means biasing each of said platform members into engagement with said spacing means, said spacing means having a major dimension, a minor dimension and a diagonal dimension exceeding said major dimension, and means for moving said spacing means from a first locked position wherein said platform members are separated by said major dimension through a second position wherein said platform members are separated by said diagonal dimension to a third collapsed position wherein said platform members are separated by said minor dimension.

4. A flowmeter comprising support means including inlet and outlet elements, a flow tube mounted between said inlet and outlet elements, and a collapsible locking assembly for removably locking said tube in operating position, said assembly including first and second platform members, one of said members abutting a portion of said flow tube, the other of said members abutting one of said elements, spacing means located between said platform members, spring means biasing said platform members into engagement with said spacing means, said spacing means having a rectangular cross-section, and means for moving said spacing means from a first locked position wherein said platform members are spaced by the length of said rectangle to a second released position wherein said platform members are spaced by the width of said rectangle so that, said tube may be alternatively locked in said flowmeter or released therefrom.

5. A flowmeter comprising support means including inlet and outlet elements, a flow tube mounted between said inlet and outlet elements, and a collapsible locking assembly for removably locking said tube in operating position, said assemby including first and second platform members, one of said members abutting a portion of said flow tube, the other of said members abutting one of said elements, spacing means located between said platform members, spring means secured to each of said platform members for biasing said platform members into engagement with said spacing means, said spacing means having a rectangular cross-section, and handle means secured to one of said platform members for rotating said one platform member relative to said other platform member thereby rocking said spacing means from a first locked position wherein said platform members are spaced a first distance apart to a second released position wherein said platform members are spaced a lesser distance apart.

6. A flowmeter comprising support means including inlet and outlet elements, a flow tube mounted between said inlet and outlet elements, and a collapsible locking assembly for removably locking said tube in operating position, said assemby including first and second platform members, one of said members abutting a portion of said flow tube, the other of said members abutting one of said elements, spacing cylinders located between said platform members, and spring means secured to each of said platform members and passing through said cylinders for biasing said platform members into engagement with said cylinders.

7. A flowmeter comprising support means including inlet and outlet elements, a flow tube mounted between said inlet and outlet elements, and variable position locking means positioned between said tube and one of said elements for removably mounting said tube, said locking means including cam means having major and minor dimensions, and means for moving said cam means from a first locked position wherein said major dimension extends between said tube and the last mentioned element to a second released position wherein said minor dimension extends between said tube and the last mentioned element.



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