

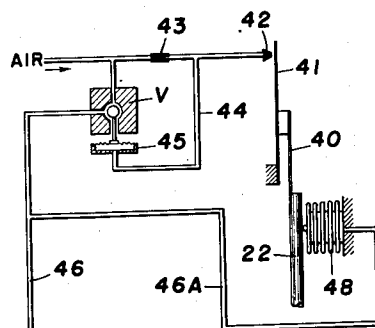
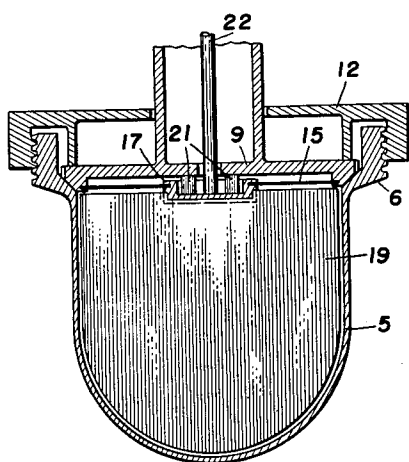
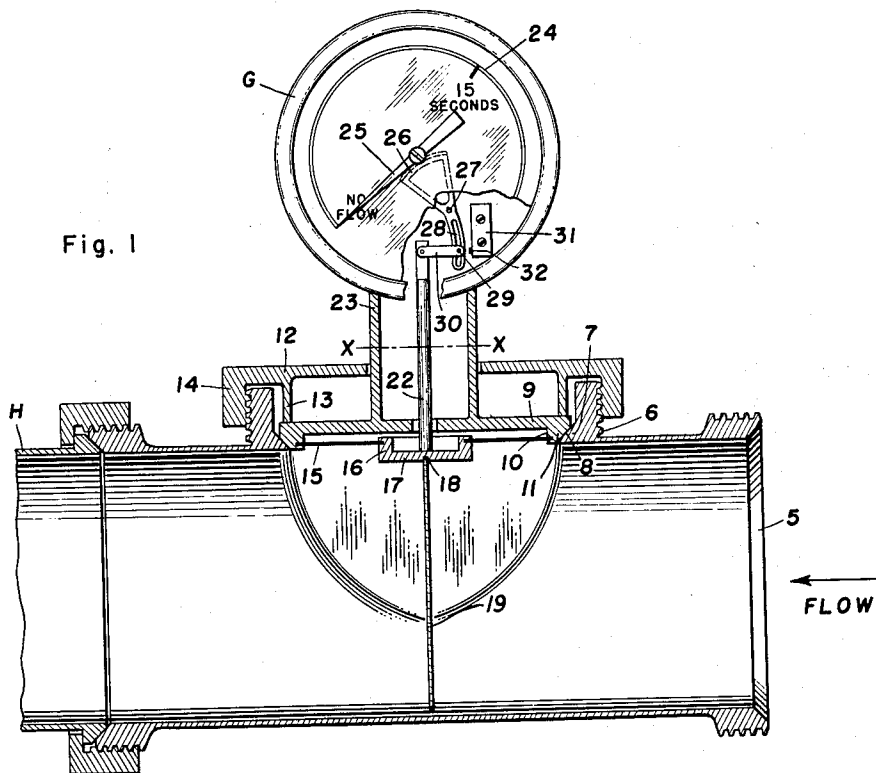
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VANE TYPE FLOWMETER

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VANE TYPE FLOWMETER

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This invention relates to a vane type flowmeter. In many processes, it is essential that the flow of a liquid through a treating stage shall not deviate from a maximum and/or minimum velocity. For example in the pasteurization of milk, the milk should flow through a so-called holder tube at a velocity such that each particle of milk will take at least fifteen seconds to travel through the tube. Such a pasteurizing system is disclosed in the patent to Olson et al. 2,522,796, granted September 19, 1950 to the common assignee of this invention.

The present invention has for its purpose, a velocity actuated device and/or indicator that is especially adapted for use in a pasteurizing system such as illustrated in the mentioned patent, although this invention is not limited to such use.

The various features and advantages of the invention will appear from the detailed description and claims when taken with the drawing in which:

Fig. 1 illustrates the device of this invention, connected in the holder tube of a pasteurizer, a portion of the device and the holder tube being shown in section;

Fig. 2 is a transverse section of a portion of the device taken at right angles to Fig. 1; and

Fig. 3 is a diagrammatic showing of a pneumatically-operated indicator with which the present device cooperates.

Referring to the drawings, the character H designates a piece of pipe which may be the holder tube of a pasteurizing system, such as illustrated in the mentioned patent. This pipe has connected therein a T-coupling 5 provided at its upper side with an externally threaded T-connection 6 which defines a side passage opening into the main passageway through the coupling. The T-connection has an annular internal shoulder 7 with a bevelled female seat 8 to receive the inverted cup-shaped plate 9 of the velocity actuated device of the present invention. This plate which has a central aperture, includes an integral annular rim 10 provided with a male bevelled seat 11 adapted to be drawn into sealed metal-to-metal relation with the seat 8 by any suitable fastening means. As herein illustrated this fastening means comprises an annular cap nut 12 which is provided at its margin with an inner flange 13 and an outer flange 14. The edge of the inner flange 13 engages the top of the plate 9 while the outer flange 14 is internally threaded to engage the threaded connection 6 whereby the bevelled seats 8 and 11 can be drawn into sealed relation. The plate 9 carries a somewhat resilient an-

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nular metal diaphragm 15 sealed at its periphery to the rim 10. The margin of the diaphragm at the central opening therein, is sealed to the rim 16 of a rigid disk 17. The diaphragm 15 and the disk 17 seal the opening into the side passage of the connection 6, when the parts are in operative position as shown in Figs. 1 and 2. The lower surface of the disk 17 has a straight kerf in which there is secured as by brazing, the edge 18 of a thin rigid vane 19, of the shape shown in Fig. 2. This vane is intended to extend across the main passage through the coupling, almost closing the same. For example, if the main passage through the coupling, has an internal diameter of two inches, the vane may have a clearance of .045 of an inch with respect to the inner surface of the coupling and the diaphragm 15. Metal strip pivots 21 (Fig. 2) have their upper ends attached to the under surface of the plate 9 and to the upper surface of disk 17, the strips extending in a plane common to the principal plane of the vane. Thus these strips tend to flex about an axis thereon, that is in alinement with the main plane of the diaphragm 15. However these strips have sufficient lengthwise rigidity to prevent any substantial bulging of the diaphragm toward the plate 9.

The upper surface of the disk 17 has centrally secured thereto, the lower end of a rigid rod or bar 22 which extends upward through the central opening in plate 9 for a purpose to be described. The pressure drop across the vane, generates a force which tends to swing the vane about the mentioned axis defined by the strips 21 with the resultant small swinging movement of the upper end of bar 22.

It has been mentioned that the vane substantially closes the passage through the coupling such that a substantial pressure drop is developed across the vane by the liquid flow through the main passage in coupling 5. If, as intended, the vane swings so slightly in response to the flowing liquid, that it essentially remains in a stationary position, the pressure drop across the vane will vary with the rate of the change of flow, according to known physical laws. Therefore, the force exerted by the fluid against the vane 19 of the present device, varies according to the rate of flow. This force which is equal to the product of the drop pressure across the vane and the surface area of the vane, may be applied to a recording, indicating or controlling mechanism to operate the same. This force may be applied directly to such mechanism or be used in a pneumatic force-balance arrangement wherein a counter-

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balancing force is generated which is substantially equal to the force exerted by the vane.

If the device, as shown in Fig. 1, is used without the usual pneumatic, force balancing unit, the diaphragm 15 and the pivot strips 21 will serve the purpose of providing a force to counterbalance the force applied to the vane by the flowing liquid. The force constants of the seal diaphragm 15 and strip pivots 21 should be so selected that the small motion of vane 19 and its attached bar 22 is just large enough to develop satisfactory energy to operate a recording, indicating or controlling mechanism. In such an arrangement the counter-balancing force is a measure of the rate of flow. In the device of Fig. 1, a hollow tube 23 attached to the top of the plate 9, surrounds the bar 22 and projects through the opening in the cap nut 12. The upper end of the tube 23 carries a gage G having a dial 24 suitably graduated such as in units of time required for the liquid to flow through the holder tube. An index 25 is rotatable on a suitable staff (not shown) to swing over the graduations on the dial. This staff is provided with a well-known pinion (not shown) to be engaged by the teeth on the sector arm 26. Arm 26 which is pivoted at 27, is slotted, at 28 near one end to receive a pivot pin 29. Pin 29 is carried by link 30 which connects the upper end of the bar 22 to sector arm 26.

In the construction of Figs. 1 and 2, when there is an increase in the velocity of the liquid flowing through pipe H, the vane 19 will swing a very small amount in a clockwise direction with the result that bar 22 acting through link 30 and sector arm 26, moves the index 25 in a clockwise direction in correspondence with the changing velocity.

In the pasteurizing system disclosed in the mentioned patent, provision is made to stop the milk pump when the milk is pumped through the holder tube at an excessive rate. For this purpose the present gage is equipped with a snap-acting electrical switch 31, the button 32 of which is engaged by the sector arm 26 in a predetermined position thereof. Thus when the velocity of flow of the liquid through the main passage reaches a given value the sector arm engages the button 32 to open the switch 31 whereby the circuit of the pump motor (not shown) is opened to stop the milk pump (likewise not shown). It will be understood that button 32 limits the clockwise movement of the index. However the use of this switch is optional.

If the present device is to be operated on the pneumatic force balance principle instead of the mechanical force balance arrangement just described, the construction diagrammatically illustrated in Fig. 3 replaces the portion of Fig. 1 above the broken line X—X. In the pneumatic force balance arrangement, the upper end of the rod 22, which is actuated by the vane 19, carries a leaf spring 40. This spring has its upper end secured to an intermediate baffle spring 41 which is fixed mounted at its lower end whereby the slight motion of the upper end of the bar 22 applies the motion of the upper end of the baffle 41. The upper end of the baffle cooperates with a nozzle 42 to control the escape through the nozzle of compressed air supplied thereto through orifice or restriction 43 from a compressed air source. As the escape of the compressed air through the nozzle is varied by the position of the baffle, the back pressure in the nozzle pipe 44 is correspondingly varied. As a result of this, the capsular chamber 45 of the relay air valve V is operated 75

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to inversely control the pressure of the air supplied to the pipe 46, leading to an operating bellows (not shown) of an indicating and/or controlling instrument 47 to actuate the same. The pressure of the air in pipe 46 is communicated through branch pipe 46A to the bellows 48. The operation of the mechanism just described, operates until the force developed by the bellows 48 is equal to the force developed by the upper end of the rod 22.

What I claim is:

1. A device adapted for use with an integral unit having a straight portion defining a main passage and having a side connection defining a side passage communicating the main passage, for measuring the velocity of flow of a liquid through said main passage, said side connection being externally threaded and having an internal female seat located at and surrounding the junction of said side passage with said main passage, said device comprising an annular plate having a peripheral flange provided with a male seat adapted to mate with said female seat to provide a liquid tight seal therebetween, a cap nut engaging the external threads on said side connection and provided with means adapted to force the plate toward the female seat, a somewhat resilient diaphragm sealed to said peripheral flange and extending in a plane parallel to that of said plate, a rigid member mounted on a central part of the diaphragm, a rigid vane mounted on one side of said member to extend transversely of said main passage and to substantially close the space defined by the diaphragm and the related portion of the straight passage, an element secured to the other side of said member, and indicating means controlled by said element.

2. A device adapted for use with an integral unit having a straight portion defining a main passage and having a side connection defining a side passage communicating with the main passage, for measuring the velocity of flow of a liquid through said main passage, said side connection being externally threaded and having an internal female seat, located at and surrounding the junction of said side passage with said main passage, said device comprising an annular plate having a peripheral flange provided with a male seat adapted to mate with said female seat to provide a liquid tight seal therebetween, an annular cap nut engaging the external threads on said side connection and provided with means adapted to force the plate toward the female seat, a somewhat resilient diaphragm sealed to said peripheral flange and extending in a plane parallel to that of said plate, a rigid member mounted on a central part of the diaphragm, a rigid vane mounted on one side of said member to extend transversely of said main passage and to substantially close the space defined by the diaphragm and the related portion of the straight passage, a rigid bar secured to the other side of said member and projecting through the annular cap nut, and indicating means controlled by said bar.

3. A device adapted for use with an integral unit having a straight portion defining a main passage and having a side connection defining a side passage communicating the main passage, for measuring the velocity of flow of a liquid through said main passage, said side connection being externally threaded and having an internal female seat located at and surrounding the junction of said side passage with said main passage, said device comprising an annular plate having a peripheral flange provided with a male seat

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adapted to mate with said female seat to provide a liquid tight seal therebetween, a cap nut engaging the external threads on said side connection and provided with means adapted to force the plate toward the female seat, a somewhat flexible diaphragm sealed to said peripheral flange and extending in a plane parallel to that of said plate, a rigid member mounted on a central part of the diaphragm, a flat rigid vane mounted on one side of said member to extend transversely of said main passage and to substantially close the space defined by the diaphragm and the related portion of the straight passage, at least one pivot strip extending generally in the plane of said vane, said pivot strip having its ends respectively connected to said plate and to

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said member, an element secured to the other side of said member, and indicating means controlled by said element.

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The following references are of record in the file of this patent:

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2,037,575	Hamilton et al.	Apr. 14, 1936
2,522,796	Olson et al.	Sept. 19, 1950