Dec. 22, 1953 W. DOUGLASS ET AL 2,663,467

FLEXIBLE SLEEVE IRIS VALVE

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FIG. 1.

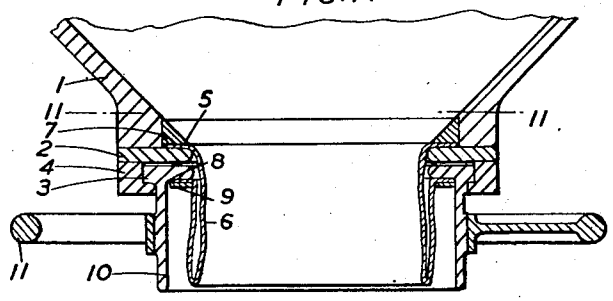


FIG. 2.

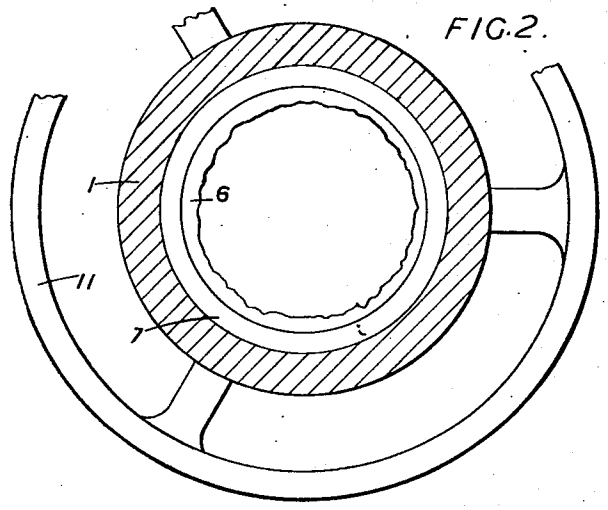


FIG. 3.

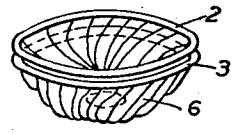


FIG. 5.

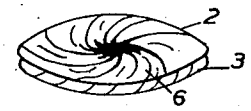


FIG. 4.

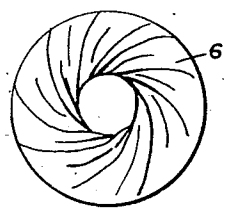
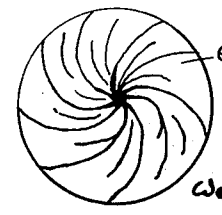


FIG. 6.



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FIG.7.

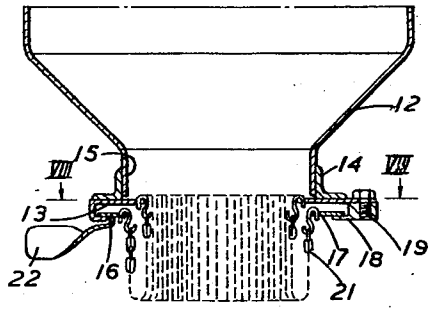


FIG.8.

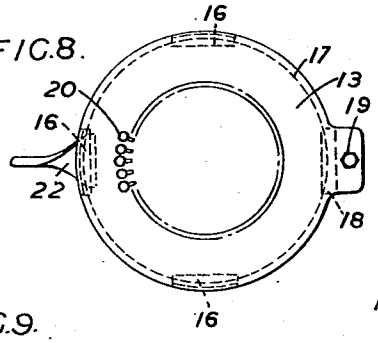


FIG.9.

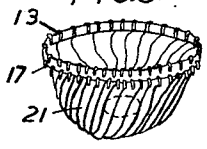


FIG.10.

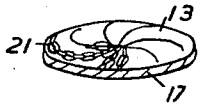


FIG.11.

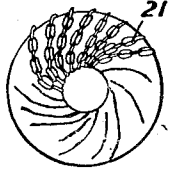


FIG.12.

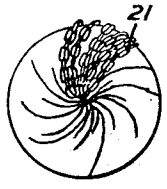
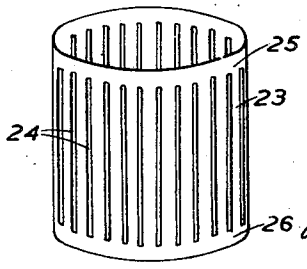


FIG.13.



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FLEXIBLE SLEEVE IRIS VALVE

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Application July 19, 1947, Serial No. 762,072

6 Claims. (Cl. 222—507)

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This invention relates to means for controlling the flow of materials and is particularly, though not exclusively, intended for interrupting the downward flow of divided material, such as flaky gelatine.

It has already been proposed to control the delivery of material from a hopper by providing a sleeve of flexible material which is distended between relatively rotatable rings, the sleeve being disposed vertically below the hopper and being adapted to interrupt the flow of material upon rotation of one or both of the rings. Owing to the use of a distended tube, the prior proposal necessitates the provision of guide means which permits vertical movement of the bottom ring during rotation thereof to twist the tube to a closed condition. An object of the present invention is to provide an improved form of flexible sleeve valve which eliminates the guiding means of the prior proposal and which can be utilised where there is only a relatively restricted space below the hopper or other receptacle for the material.

Another object of the invention is to provide a valve in which a flexible sleeve folded back on itself is connected to a pair of relatively rotatable rings which are protected against contamination by the material during passage through the sleeve.

A further object of the invention is to provide a fabric sleeve valve which according to the material selected for the sleeve can be used for controlling the flow of a wide variety of materials whether gaseous, liquid or solid.

A still further object of the invention is to provide a valve composed of few parts, simple in construction and embodying a flexible sleeve which is readily detachable for substitution by another sleeve.

Yet a further object of the invention is to provide a flexible sleeve valve in which during operation to interrupt the flow of material the sleeve becomes twisted to a substantial iris diaphragm form.

These and other objects of the invention will be apparent from the following description.

A preferred form of the invention as applied to a hopper or mixer for hard gelatine in leafy or flaky form will now be described by way of example with reference to the accompanying drawings in which:

Fig. 1 is a cross sectional elevation of a sleeve valve fitted beneath the lower part of a mixing hopper.

Fig. 2 is a sectional plan view on the line II—II, Fig. 1.

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Fig. 3 is a perspective view showing the sleeve in a partly closed position.

Fig. 4 is a plan corresponding to Fig. 3.

Fig. 5 is a perspective view showing the sleeve completely closed.

Fig. 6 is a plan view corresponding to Fig. 5.

Fig. 7 is a cross-sectional elevation of a hopper fitted with a modified form of valve, according to the invention, the flexible sleeve being constituted by a multiplicity of chains.

Fig. 8 is a sectional plan view on the line VIII—VIII of Fig. 7.

Figs. 9 and 11 are diagrammatic views showing the flexible sleeve valve according to Figs. 7 and 8 partially open.

Figs. 10 and 12 are diagrammatic views showing the flexible sleeve valve of Figs. 7 and 8 completely closed.

Fig. 13 is a diagram illustrating an alternative form of flexible sleeve for use in the valve according to the invention.

The lower end of a mixing hopper 1 for hard gelatine in flaky form is provided with a fixed ring 2 bolted to the hopper. Another ring 3 disposed co-axially with the ring 2 is mounted below and close to the ring 2 upon a retaining ring 4 which is also bolted to the hopper 1. One end 5 of a sleeve of flexible material 6 is secured to the upper surface of the ring 2 by means of a fillet ring 7 which is shaped internally to provide a smooth continuation of the interior sloping wall of the hopper 1. The sleeve 6 is folded back on itself and is secured at its other end 8 by means of a clamping ring 9 to the lower surface of an inwardly directed flange of the ring 3.

The full length of the sleeve compared with its diameter is preferably chosen so that the sleeve can be twisted from the fully open position illustrated in Fig. 1 to the fully closed position illustrated in Figs. 5 and 6 in less than one complete revolution of the ring 3 in either direction. To effect this, the full length of the sleeve should be slightly greater than the diameter thereof. To facilitate rotation of the ring 3, it may be provided with a depending circular flange 10 to which a hand wheel 11 is secured. Said hand wheel 11 functions as a control means to vary the valve opening from fully open to fully closed position.

It has been found that a valve of this construction with a sleeve made of strong fabric, such as twill, can be very effectively used for interrupting the downward flow of leafy or flaky gelatine from the hopper 1. By folding the sleeve back on itself and connecting the ends to the

rings 2, 3, in the manner illustrated in Fig. 1, it is impossible for the material to get into and clog the moving parts. This is of considerable advantage where adherent materials, such as flaky gelatine are controlled by the valve, as when metal slide valves are used for interrupting the flow of this material they very quickly become clogged and require the use of considerable pressure to operate them and also frequent cleaning.

A further advantage arising from folding the sleeve back on itself and connecting it to the rings 2, 3, as illustrated, is that the sleeve can be opened and closed without involving an endwise relative movement of the rings. Figs. 3 and 4 illustrate the condition of the sleeve in a partly closed condition whereas Figs. 5 and 6 show the sleeve completely closed in which it is a substantially taut diaphragm. In practice, particularly where the material to be controlled is flaky gelatine, it may not be necessary for the sleeve to be closed fully since in closing it binds on the material falling through the hopper and effectively interrupts the flow.

The invention is not limited to the specific construction hereinbefore described in which the upper ring 2 is fixed and the lower ring 3 is rotatable; if desired the lower ring 3 can be fixed and the upper ring made rotatable. Alternatively, both rings may rotate together in opposite directions to effect opening and closing of the sleeve. Further, instead of mounting the rings 2, 3 in superposed relation, as illustrated, they may be mounted concentrically with respect to each other.

Although the present invention is particularly useful for controlling the outlet of a mixer for flaky gelatine, it will be appreciated that the cut-off valve can be applied to a variety of uses, and in general can be used for controlling the flow of other solid materials, such as grain, sand, or the like. Also, by a suitable choice of material for the flexible sleeve, the cut-off valve may be used for liquids such as treacle, tar, acids, and the like.

It has been found by practical experience that a sleeve made of flexible material, such as strong fabric, is completely efficient for controlling or interrupting the flow of a wide variety of gaseous, liquid and solid materials. The form of the invention illustrated by Figs. 7–12 comprises a modification which is particularly suitable for controlling or interrupting the flow of solid materials such as coal, coke, coarse gravel, and other materials of similar bulk.

Figs. 7 and 8 illustrate a hopper 12 for bulky materials, such as lumps of coal. Below its throat a stationary ring 13 is secured to a flanged ring 14 of the hopper throat 15. The stationary ring is provided with three inwardly directed flanges 16 which support a rotatable ring 17 situated below and co-axial with respect to the stationary ring 2. The ring 17 is also partly supported by a detachable flange 18 secured by a bolt 19 to the ring 13. The flange 18 is applied after the ring 17 has been seated on the flanges 16. The inner peripheries of both rings are provided with an equal number of drilled holes 20, Fig. 8, to receive the ends of a plurality of metal chains 21 of equal length. The assembly of rings and chains constitutes a valve. When the valve is in the open position each chain is suspended from the rings in festoon form as indicated in Fig. 7. The chains, as an assembly, constitute in effect a sleeve of flexible material folded back on itself and secured at its ends to the rings.

The rotatable ring 17 is provided with a finger piece 22 by means of which it may be rotated to close the valve without involving any axial movement of the rings 13, 17 with the result that the chain festoons are crowded together in a volute form below the hopper throat to interrupt the flow of the material from the hopper. The piece 22 functions as a control means to vary the valve opening from its fully open to its fully closed position. In such position of the valve, the chains exert a throttling action on any piece, or pieces, of material that get caught in the chains. When the valve is opened by turning the rotatable ring in the opposite direction, the chains assume their normal festooned form. Figs. 9 and 11 diagrammatically illustrate the valve partially closed, while Figs. 10 and 12 illustrate it completely closed. The full length of the chain sleeve compared with its diameter is preferably so chosen that the sleeve can be twisted from the fully open position, Fig. 7, to the fully closed position, Figs. 10 and 12, in less than one complete revolution of the ring 17.

It will be understood that the invention is not limited to the use of a flexible sleeve composed of chains as the multiplicity of flexible elements constituting it may take other forms. For example, as illustrated in Fig. 13, the sleeve is made of flexible material, such as strong fabric, slit longitudinally to provide a multiplicity of narrow strips 23. The slits 24 terminate short of the sleeve ends to provide bands 25, 26 which are secured to the rings 13, 17 after the sleeve has been folded back on itself.

In operation, a valve constructed with such a sleeve operates in substantially the same way as that illustrated in Figs. 7 and 8.

It will be appreciated that, as in the case of the construction disclosed in Figs. 1–6, the lower ring may be stationary and the upper ring may be rotatable. Alternatively, both rings may be mounted to rotate together in opposite directions to effect opening and closing of the valve. Further, both rings, instead of being in superposed relation, as is preferred, may be mounted concentrically with respect to each other.

We claim:

1. A container comprising a tubular member, a tubular collar telescoped over said tubular member and rotatable with respect thereto, the upper edge of said collar lying in substantially the same plane as the upper edge of said tubular member, a tubular piece of flexible material forming a closure for one end of said container, one end of said tubular piece of flexible material being attached to said tubular member, and the other end being attached to said collar with a loose, unattached portion between said attached ends, said loose, unattached portion being folded backwardly on itself and puckering inwardly on rotation of said collar relative to said tubular member to form a diaphragm consisting of folds converging toward the center of said tubular member, and means to prevent longitudinal movement of said collar relative to said tubular member when said collar is rotated thereon, which said means also serves to limit the rotating movement of said collar with respect to said tubular member.

2. A flow control device, comprising, in combination, a pair of rings; means for locating said rings in adjacent coaxial relationship; means for angularly moving at least one of said rings with respect to the other; means for preventing an axial movement of said rings with respect to each other; a flexible sleeve, said sleeve being

composed of a plurality of flexible elements each folded back on itself so as to define a flow passage; means for attaching one end of said sleeve to one of said rings along a first line of attachment; and means for attaching the other end of said sleeve to the other of said rings along a second line of attachment located near to and at a distance from said first line of attachment which is substantially smaller than the length of said flexible sleeve, whereby by an angular movement of said rings with respect to each other said sleeve may be twisted from a condition in which the flow device is open to a substantial diaphragm form so as to regulate the effective diameter of said flow passage.

3. A flow control device, comprising, in combination, a pair of rings; means for locating said rings in adjacent coaxial relationship; means for angularly moving at least one of said rings with respect to the other; means for preventing an axial movement of said rings with respect to each other; a flexible sleeve, said sleeve being composed of a plurality of flexible chains each folded back on itself so as to define a flow passage; means for attaching one end of said sleeve to one of said rings along a first line of attachment; and means for attaching the other end of said sleeve to the other of said rings along a second line of attachment located near to and at a distance from said first line of attachment which is substantially smaller than the length of said flexible sleeve, whereby by an angular movement of said rings with respect to each other said sleeve may be twisted from a condition in which the flow device is open to a substantial diaphragm form so as to regulate the effective diameter of said flow passage.

4. A flow control device comprising a pair of rings, bearing means for seating said rings in adjacent coaxial relationship, a flexible sleeve folded back on itself to define a flow passage, perimetral attaching means for securing one end of said sleeve to one of said rings along a first line of attachment, a second perimetral attaching means for securing the other end of said sleeve to the other of said rings along a second line of attachment, and flange means engaging selected of said rings for preventing axial movement of said rings in either direction on said bearing means but permitting relative rotary movement to twist said sleeve and form an iris valve operable from fully open to fully closed position while said flange means holds said rings against axial movement.

5. A flow control device comprising a pair of rings, bearing means for seating said rings in

adjacent coaxial relationship, flange means engaging selected of said rings for preventing axial movement of said rings in either direction on said bearing means but permitting relative rotary movement of said rings, a flexible sleeve folded back on itself to define a flow passage, perimetral attaching means for securing one end of said sleeve to one of said rings along a first line of attachment, a second perimetral attaching means for securing the other end of said sleeve to the other of said rings along a second line of attachment, and control means for angularly moving at least one of said rings with respect to the other in one direction to twist said sleeve and form a diaphragm to fully close the opening through the said rings and in the other direction to regulate the effective opening through said rings to its fully open position while being held against axial movement by said flange means.

6. A flow control device comprising a pair of rings, bearing means for seating said rings in adjacent coaxial relationship, a control means for angularly moving at least one of said rings with respect to the other on said bearing means, flange means engaging selected of said rings for preventing axial movement of said rings in either direction on said bearing means but permitting relative rotary movement of said rings, a flexible sleeve folded back on itself to define a flow passage, a perimetral attaching means for securing one end of said sleeve to one of said rings along a first line of attachment, and a second perimetral attaching means for securing the other end of said sleeve to the other of said rings along a second line of attachment, said second perimetral attaching means having its line of attachment located closely adjacent to the first line of attachment to produce a load bearing diaphragm substantially in the plane of said rings when said control is moved in one direction to fully close the flow passage and when moved in the opposite direction to regulate the effective open diameter of the flow passage through said rings while said flange means holds said rings against axial movement.

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ALEXANDER CHARLES ELLIS.

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