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(54) CONTROL VALVE

(71)We, ERNST FLITSCH GmbH & CO., a German Company, of D-7012 Fellbach, Stuttgarter Str. 62, Germany, do hereby declare the invention, for which we pray that a Patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

This invention relates to a control valve, and has particular application to a valve suitable for controlling the flow of liquids, vapours, and their mixtures, as they occur in mechanical refrigeration systems.

The relatively simple needle valves and cone valves available for controlling refrigerant lines tend to cause vibrations and cavitation in a liquid whose flow it is desired to control. The known valves which avoid such shortcomings are relatively complex and costly.

The present invention seeks to provide a simple control valve suitable for controlling the flow of a fluid under high pressure in precisely metered increments while avoiding shortcomings of other simple valves.

Acording to the invention there is provided a control valve comprising a casing having a valve chamber with an inlet leading to the chamber, an outlet leading from the chamber and an opening to the chamber in which a valve spindle is journalled about an axis extending transversely of flow from the inlet to the outlet, an annular valve seat in the chamber at the outlet, a spherical valve member engaging the valve seat for flow control by means of a tapered notch extending along part of the equator of the spherical member, the spherical valve member being fixed to one end of the spindle for rotation about the axis, a cover sealingly enclosed the said opening over the other end of the spindle and means for rotating the valve member comprising actuating means outside the cover and actuated means inside the cover attached to the spindle for rotation therewith.

The invention will further be described with reference to the accompanying drawings, of which:-

Figure 1 shows a valve of the invention in elevational section;

Figure 2 illustrates the valve in section on the line 2-2;

Figure 3 is a sectional view of the same valve taken on the line 3-3 in Figure 2; and

Figure 4 shows the spherical valve member of the valve and associated pressure plate in section on the line 4-4 in Figure 1.

Referring to the drawings, the valve comprises a body portion 1 of a casing which is a metal casting integral with an externally threaded inlet nipple 2 and an outlet nipple 3, externally and internally threaded and coaxial with the inlet nipple 2. The central cavity of the casing body 1 has a side window 4 sealed by a heavy sight glass 5. The open top of the casing cavity is sealed by a flanged cover 6 of austenitic stainless steel or other non-magnetic material which has the shape of an inverted cup.

A sleeve 7 is threadedly received in the outlet nipple 3, and its enlarged end portion in the central casing cavity provides an annular valve seat for a spherical valve member or ball 8. The ball 8 is held in sealing engagement with the valve seat on the sleeve 7 by a flat pressure plate 10 biased into point contact with the spherical outer surface of the ball 8 by a spring clip 9 abuttingly retained in the inner orifice of the inlet nipple 2.

The ball 8 may be turned by means of a fixedly attached stem 11 about an axis which intersects the common axis of the nipples 2, 3 and of the sleeve 7 at right angles in the geometrical centre of the ball 8. The otherwise continuously spherical, outer face of the ball 8 is formed with a notch 81 elongated in a plane perpendicular to the axis of the stem 11 through the ball centre.

In the open position of the valve, the notch 81 has a narrow and shallow longitudinal end communicating with the outlet nipple 3. It flares longitudinally both in its width and its depth, and its other end comunicates with the central cavity of the casing body 1 and the inlet nipple 2. The notch 81 is symmetrical relative to the aforementioned perpendicular plane and extends about an approximate arc of 90° of the ball circumference.

The stem 11 is journalled in a central sleeve portion of a disc 12 having a circumferential flange axially directed towards the ball 8. The flange of disc 12 envelopes an axial flange of another disc 13, spacedly parallel to the disc 12. Stem 11 passes through disc 13. The disc 12, 13 thus form a flat cylindrical box packed with asbestos fibres which filter particulate solids from the fluid controlled by the valve and prevent contamination of the bearing for the stem 11 in the sleeve portion of the disc 12. The box 12, 13 is fixedly secured in the casing body 1 by a tight friction fit.

An armature 20 of mild steel is mounted on the portion of the stem 11 which extends into the cover 6 and is embedded in a cylindrical body 14 of plastics material which is rotatable within the cover 6. Two axial, eccentric pins 15 fixedly fastened on the disc 12 project into respective grooves of the body 14. As is best seen in Figure 3, the grooves each extend in an arc of about 90° about the axis of the stem 11, and the angular, joint movement of the body 14, the armature 20, the stem 11, and the ball 8 is limited by abutting engagement of the pins 15 with the transverse end walls of the grooves.

A plate 16 has an integral, central hub portion frictionally secured on the stem 11 between the ball 8 and the box 12, 13. A circumferential, depending skirt portion of the plate 16 carries a row of embossed indicia 16' of which only one is visible in Figure 2. The indicia may be viewed through the sight glass 5 and give a precise indication of the angular position of the ball 8 and of the effective flow section of the notch 81.

The ball 8 may be turned by means of an electromagnet of which only the lamellar core 17 is shown in the drawing. The energising wire windings enveloping one pole of the magnet core have been omitted in order not to crowd the drawing. A gap 18 between the cylindrical circumference of the cover 6 (Figure 3) and the one magnet pole normally carrying the windings or coil of the magnet decreases in width from one circumferential end to the other so that the stem 11 is turned in one direction only when the magnet is energised in a conventional manner.

When the current flow to the magnet is interrupted, the ball 8 is returned to its intitial angular position by a spiral spring 19 of non-magnetic phosphor bronze wire whose ends are fastened to the stem 11 and the inner face of the cove 6 respectively. Depending on the intended application, the spring 19 may bias the ball 8 and the stem 11 towards the open or closed valve position, the other valve position being reached by energising the electromagnet which overcomes the restraint of the spring 19.

The illustrated valve is capable of many modifications which will readily suggest themselves to those skilled in the art. While a single notch 81 is preferred and adequate for refrigeration service, two diametrically opposite notches may be provided as long as the ball 8 has a solid portion extending from the geometrical centre of the ball in all directions over a radius at least equal to the spacing of the illustrated notch 81 from the ball centre.

The spring 19 may be replaced by a permanent magnet mounted on the stem 11 in the plastic body 14. The permanent magnet (not shown) may be positioned in any obvious manner to return the ball 8 to its starting position after deflection by the electromagnet.

The energising circuit of the partly illustrated electromagnet has not been shown since it may be entirely conventional. It may include temperature responsive elements which control the current flowing through the non-illustrated coil of the electromagnet in response to changes in the temperature of a refrigerated space or object.

It should be understood that the invention is not intended to be restricted to the details of the above described embodiment.

WHAT WE CLAIM IS:-

1. A control valve comprising a casing having a valve chamber with an inlet leading to the chamber, an outlet leading from the chamber and an opening to the chamber in which a valve spindle is journalled about an axis extending transversely of flow from the inlet to the outlet, an annular valve seat in the chamber at the outlet, a spherical valve member engaging the valve seat for flow control by means of a tapered notch extending along part of the equator of the spherical member, the spherical valve member being fixed to one end of the spindle for rotation about the axis, a cover sealingly enclosed the said opening over the other end of the spindle and means for rotating the valve member comprising actuating means outside the cover and actuated means inside the cover attached to the spindle for rotation therewith.

2. A valve as claimed in Claim 1, wherein the notch is symmetrical relative to the equator of the spherical valve member.

3. A valve as claimed in either of the preceding claims further comprising yieldably resilient means in the cavity pressing the valve member towards the valve seat.

4. A valve as claimed in Claim 3 wherein the yieldably resilient means include a pressure plate making contact with the valve member at the equator opposite the valve seat, and a spring interposed between the casing and the pressure plate.

5. A valve as claimed in any of the preceding claims, further comprising cooperating abutment means fixed to the valve member and on the casing for preventing angular movement of the valve member beyond two positions thereof.

6. A valve as claimed in any of the preceding claims, further comprising an arcuate scale connected to the valve member in the casing for joint angular movement about the axis, the casing having a transparent wall portion whereby the scale is visible from outside the casing through the wall portion.

7. A valve as claimed in any of the preceding claims, wherein the valve member has a solid portion extending from its centre in all directions over a radius at least equal to the spacing of the notch from the centre.

8. A control valve as claimed in any of the preceding claims wherein the actuating means provides magnetic flux which passes through the cover to urge rotation on the actuated means which is an armature of magnetic material.

9. A control valve as claimed in claim 8 including means within the cover for returning the armature, and valve member, to an initial position when the said urging ceases.

10. A control valve as claimed in claim 9 wherein the armature return means is a spring acting in torsion between the spindle or other member attached thereto, and the cover or other member attached thereto.

11. A control valve as claimed in claim 9 wherein the armature return means is a permanent magnet attached to the spindle.

12. A control valve as claimed in any one of claims 9 to 11 wherein the actuating means is an electromagnet.

13. A control valve as claimed in claim 12 wherein the electromagnet has a pair of pole pieces, the faces of which face the armature defining with the armature respective gaps which extend circumferentially relative to the axis and increase in width in a circumferential direction.

14. A control valve as claimed in any one of claims 8 to 13 wherein the cover is of non-magnetic material.

15. A control valve substantially as hereinbefore described with reference to the accompanying drawings.

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2 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 1

Fig. 1

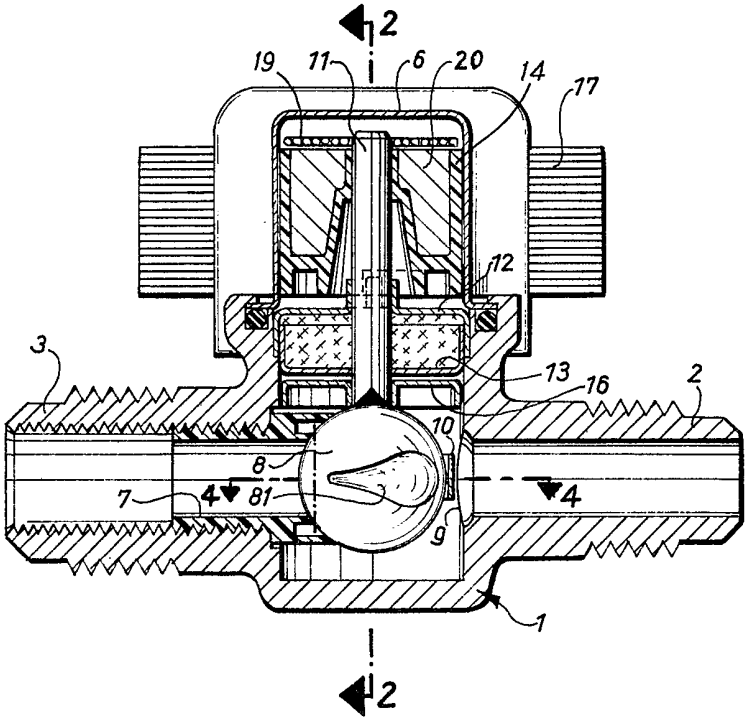

Fig. 4

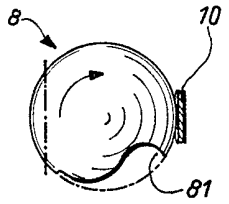

Fig. 2

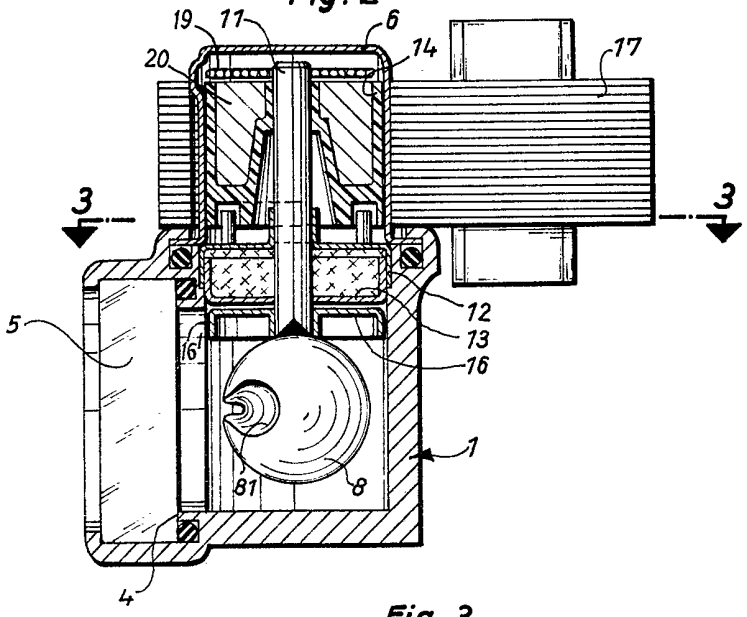

Fig. 3