Sept. 29, 1964 W. GSCHING 3,150,492

FLUID FLOW SYSTEM WITH ANNULAR SLIDE

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Fig. 1

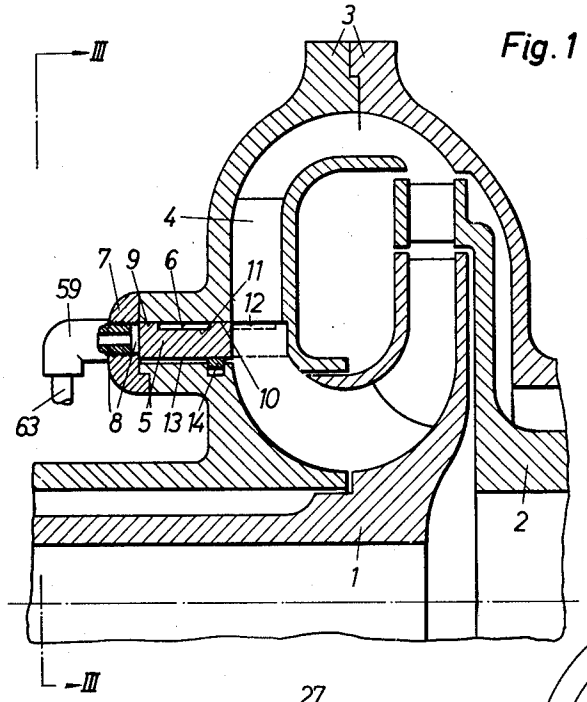
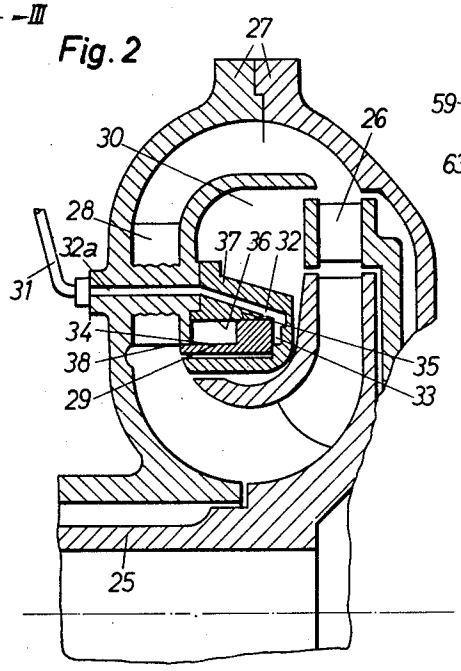



Fig. 2



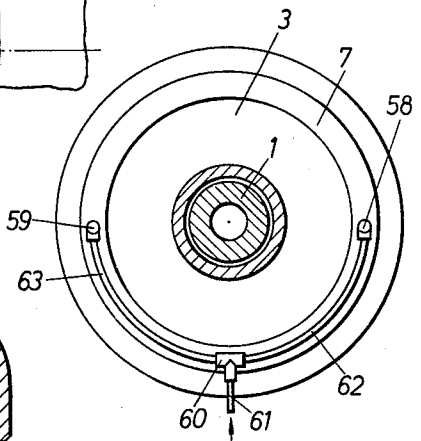




Fig. 3

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# FLUID FLOW SYSTEM WITH ANNULAR SLIDE

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The present invention relates to fluid flow machines and, more particularly, to a fluid flow system with annular slide.

In fluid flow systems, it is known for purposes of interrupting or throttling the power flow to provide axially insertable annular slides. The arrangement is generally such that the said slide when occupying its opening position is guided over its entire width whereas said slide when occupying its closing position is guided over a portion of its width. If only a portion of the width is guided, especially when the said slide is to be opened again from its closing position, a canting or tilting of said slide easily occurs so that a proper actuation thereof is impaired. The actual reasons for this deficiency consist in the rather unfavorable ratio of guiding width to guiding diameter which ratio however with slides of the type involved is necessary for reasons of lack of space and weight.

In an effort to overcome this drawback, it has been suggested to employ one of the circuit shafts for the guiding of the annular slide. While such an arrangement creates a close guiding of said slide which assures an actuation of the latter without canting or tilting, such an arrangement however is rather expensive and requires considerable space.

A good guide is particularly necessary in connection with hydraulically or pneumatically actuated slides of the type involved because in these instances no direct control exists for the effected displacement of the slide and since furthermore the opening of said slide is frequently effected only by means of the relatively small forces of the inner pressure of the system. When employing pressure fluid actuated slides, there is additionally to be considered that heretofore the pressure fluid was supplied to the slide passage at one point only and at this point already a displacing force was exerted upon the slide whereas at the other points along the circumference of the annular piston, only gradually, namely, with the spreading of the pressure wave, the displacement pressure occured. It is this displacing force at one single point of the annular system which caused a tilting as a result of which the actuation of the slide became even doubtful.

It is, therefore, an object of the present invention to provide a fluid flow system with rotatable slide which will assure that the said slide will be guided not only outside the fluid flow chamber but also in said fluid flow chamber.

It is a further object of this invention to provide a fluid flow system with a rotatable slide which will make it possible to guide the latter in closing and opening position over its entire width.

It is still a further object of this invention to provide an arrangement as set forth in the preceding paragraphs, in which a proper displacement of the slide will also be assured when hydraulically or pneumatically actuating the slide by means of an annular piston.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawings, in which:

FIG. 1 illustrates a partial, longitudinal section through a torque converter circuit with a rotatable slide insertable from the outside;



FIG. 2 is a partial, longitudinal section through a converter circuit with a slide insertable from the inside;

FIG. 3 diagrammatically illustrates the arrangement for the pressure fluid supply to the slide.

The present invention is characterized primarily in that for purposes of a safer actuation and for avoiding tilting or turning over edge of the annular slide without increasing the manufacturing costs and the place for said slide, guiding means is provided also in the fluid flow chamber itself so that the said slide will be guided not only outside the fluid flow chamber but also within the latter. In the most favorable instance, the slide is guided over its entire width in closed as well as in open position. Thus, the slide is guided in closing position as satisfactorily as it was heretofore the case when the slide was in its opening position.

For guiding the slide in the fluid flow chamber, advantageously the blade rings are employed and, more specifically, so that the blades of a blade ring adjacent to the slide are provided with such edges which are all equally spaced from the axis and which for the closed slide form the additional guiding means at the outer or inner diameter thereof. In this way, it will be possible to guide the slide in all positions over its entire width. The cost of such an arrangement consists merely in that these edges will have to be produced by turning and grinding.

Advantageously, the slide guiding means are arranged outside the fluid flow chamber on the same diameter as the guiding edges of the blades, and some play is provided on the non-guided cylindrical surface. This arrangement yields guiding means which are easily produced and are not over determined.

With a fluid flow system designed as converter and having a guide wheel ring adjacent to the slide, advantageously the inlet and outlet edges of said converter are machined so that they will form the additional guiding means.

According to another feature of the invention, a tilting free sliding of the slide will be obtained without high costs by giving not only a portion of the guiding means a smaller and thereby a more suitable diameter but also by simultaneously widening the guiding path. To this end, only that end of the slide which is remote from the closable portion of the fluid flow chamber is guided on its outer or inner surface and additionally is connected with a further axial guide located on a smaller diameter. This guide is provided on that wall of the fluid flow chamber which is located radially mostly inwardly and in the same portion of the fluid circuit as the other guiding means. At the same time, these two guides or guiding means are axially offset with regard to each other. The two guides of the slide are connected for instance by radially extending ribs which, if they cross the circuit flow, have a unilaterally rounded or pointed cross section in order to reduce the fluid flow resistance to a minimum.

According to a further development of the invention, the connection of the two guides is so effected that it entirely or partially in opening position of said slide will represent a portion of the circuit de-limitation. The slide is so arranged that it will be closed from the outer delimitation of the fluid flow chamber or from the core chamber. If the inner supporting wall represents only a portion of the connection of the two guides for the slide, the remaining connection is effected for instance by webs which are arranged in a certain number distributed over the fluid flow chamber and are so designed that the fluid flow resistance will be increased as little as possible.

Also with this arrangement, the construction costs are

relatively low because the slide can well be machined even though due to its supporting wall it is larger than normally. Furthermore, the inner guiding surface on the slide as well as on the fluid flow chamber can easily and absolutely concentrically with regard to the corresponding other guiding surface be produced with a single mounting on the machine tool.

In order to make the fitting requirements for such double guiding not too high, the two axially oppositely located guiding surfaces on the slide may have their entire width dimensioned relatively small with regard to the total width. In this way the two guides are adapted elastically to yield relative to each other.

Finally, in order to assure a proper displacement of the slide, also when hydraulically or pneumatically actuating the slide by means of an annular piston, it is suggested in conformity with the present invention that the pressure fluid connecting portions of the annular piston are at least approximately uniformly distributed over the circumference and that the pressure fluid supply lines to said connecting portions are at least approximately of the same length counting from the distributing point of the main supply line. Preferably, the annular piston is directly connected to the slide. The most simple arrangement consists in that the connecting portions are offset to each other by 180° while the branching point is offset by 90° to each connecting portion. From this branch point, the distance to the two connecting portions is substantially the same, i.e., the pressure wave of the pressure fluid actuates the annular piston at the same time at two portions offset with regard to each other by 180° and thus initiates the displacement of the slide so that a tilting will not be possible.

Referring now to the drawings in detail and FIG. 1 thereof in particular, the torque converter illustrated therein comprises a primary wheel **1**, a secondary wheel **2** and a housing **3** with the guide wheel blading **4**. The housing **3** comprises a guide **6** for an annular slide **5** which latter is adapted to be actuated hydraulically. To this end, pressure fluid is adapted to be passed through a conduit **7** into an annular chamber **8**. The annular slide **5** is guided along two portions **9** and **10** of its outer diameter and in addition thereto is guided at the exit edges **12** of the guide blade ring. The annular slide **5** has a recess or groove **11** in order to aid in the precision guiding along the portions **9** and **10**. When the annular slide **5** is being moved into its closing position, the portion **10** slides along the edges **12** of the guide blades up to the end position illustrated by dash lines. The annular slide **5** is thus guided in both positions over its entire width. The guide **6** and the blade edges **12** are arranged along the same diameter. The inner cylindrical surface of the annular slide is not guided but there is provided a play **13** with regard to the housing **3**. A sealing ring **14** will effect a seal at this portion.

The torque converter according to FIG. 2 comprises a primary part **25**, a secondary part **26**, a housing **27** and guide wheel blades **28**. An annular slide **29** is adapted to be placed into the circuit from the annular core chamber **30**. The pressure fluid passes through conduits **31**, **32***a*, **32** into an anular chamber **33**. The conduit section **32***a* is located in one of the guide wheel blades **28**. The guiding surfaces **34**, **35** of the annular slide **29** are guided in each position and in a highly satisfactory manner on the cylindrical surface **36** of the core member **37** pertaining to the guide wheel and are furthermore guided on the guiding wheel blade edges **38**.

FIG. 3 illustrates the end face of a torque converter with a portion of the primary wheel **1** and of the housing **3** in section while the remaining part is a view of the housing. An annular slide is guided in a portion **7** of the housing **3**. The pressure fluid for actuating said annular slide passes at two connecting portions **58**, **59** into an annular passage, said connecting portions being offset with regard to each other by 180°. A distributor member **60** connected to a feeding line **61** conveys the pressure fluid through conduits **62**, **63** to the connecting portions **58**, **59**. The distributor member is offset by 90° with regard to said connecting portions so that the conduits **62**, **63** will have the same length. The pressure wave of the pressure fluid will from the distributor member **60** always reach the annular slide at the same time at two oppositely located portions through conduits **62**, **63** and will act upon said annular slides so that a tilting will not be possible.

It is, of course, to be understood that the present invention is, by no means, limited to the particular constructions shown in the drawings but also comprises any modifications within the scope of the appended claims.

What I claim is:

1. In a hydrodynamic torque converter, a stationary converter housing, a rotating pump wheel, a rotating turbine wheel and guide wheel blading connected to the converter housing, and an annular slide arranged to be moved axially into the fluid chamber of the converter and guidingly supported in the stationary converter housing, said slide being operable for variably throttling the fluid flow in the converter and thereby controlling the power flow therethrough, said annular slide being arranged in the immediate vicinity of said guide wheel blading, said guide wheel blading being provided at that side thereof which faces the annular slide with edges evenly spaced from the axis and flush with a concentric wall surface of the annular slide so that the edges form guiding means for the annular slide.

2. In a hydrodynamic torque converter, a stationary converter housing, a rotating pump wheel, a rotating turbine wheel and guide wheel blading connected to the converter housing, an annular slide adapted to be moved axially into the fluid chamber into the path of fluid movement and guided outside the fluid chamber in the converter housing whereby said slide is operable for throttling or interrupting fluid flow in the converter and thereby the power flow therein, guide blades arranged stationarily in an annular path on said converter housing and arranged in the immediate vicinity of the annular slide so the guide blade edges facing the annular slide are evenly spaced from the axis of the converter and are flush with a concentric wall surface of the annular slide so as to form guiding means for the annular slide when it is moved inwardly into the converter.

3. In a hydrodynamic torque converter, a stationary converter housing, a rotating pump wheel, a rotating turbine wheel and guide wheel blading connected to the converter housing, an annular slide adapted to be moved axially into the fluid chamber into the path of fluid movement and guided outside the fluid chamber in the converter housing whereby said slide is operable for throttling or interrupting fluid flow in the converter and thereby the power flow therein, guide blades arranged stationarily in an annular path on said converter housing and arranged in the immediate vicinity of the annular slide so the guide blade edges facing the annular slide are evenly spaced from the axis of the converter and are flush with a concentric wall surface of the annular slide so as to form guiding means for the annular slide when it is moved inwardly into the converter, the wall surface of the annular slide which is opposite to the one that is guided on the guide blade edges being spaced from the adjacent wall of the converter housing.

4. In a hydrodynamic torque converter, a stationary converter housing, a rotating pump wheel, a rotating turbine wheel and guide wheel blading connected to the converter housing, an annular slide adapted to be moved axially into the fluid chamber into the path of fluid movement and guided outside the fluid chamber in the converter housing whereby said slide is operable for throttling or interrupting fluid flow in the converter and thereby the power flow therein, guide blades arranged stationarily in an annular path on said converter housing

and arranged in the immediate vicinity of the annular slide so the guide blade edges facing the annular slide are evenly spaced from the axis of the converter and are flush with a concentric wall surface of the annular slide so as to form guiding means for the annular slide when it is moved inwardly into the converter, the wall surface of the annular slide which is opposite to the one that is guided on the guide blade edges being spaced from the adjacent wall of the converter housing, and a seal element between the said wall surface of the slide and the said adjacent wall of the converter.

5. In a hydrodynamic torque converter, a stationary converter housing, a rotating pump wheel, a rotating turbine wheel and guide wheel blading connected to the converter housing, an annular slide adapted to be moved axially into the fluid chamber into the path of fluid movement and guided outside the fluid chamber in the converter housing whereby said slide is operable for throttling or interrupting fluid flow in the converter and thereby the power flow therein, guide blades arranged stationarily in an annular path on said converter housing and arranged in the immediate vicinity of the annular slide so the guide blade edges facing the annular slide are evenly spaced from the axis of the converter and are flush with a concentric wall surface of the annular slide so as to form guiding means for the annular slide when it is moved inwardly into the converter, said converter housing having an annular chamber receiving the annular slide and forming therewith a cylinder-piston arrangement for the fluid actuation of said slide.

6. In a hydrodynamic torque converter, a stationary converter housing, a rotating pump wheel, a rotating turbine wheel and guide wheel blading connected to the converter housing, an annular slide adapted to be moved axially into the fluid chamber into the path of fluid movement and guided outside the fluid chamber in the converter housing whereby said slide is operable for throttling or interrupting fluid flow in the converter and thereby the power flow therein, guide blades arranged stationarily in an annular path on said converter housing and arranged in the immediate vicinity of the annular slide so the guide blade edges facing the annular slide are evenly spaced from the axis of the converter and are flush with a concentric wall surface of the annular slide so as to form guiding means for the annular slide when it is moved inwardly into the converter, said converter housing having an annular chamber receiving the annular slide and forming therewith a cylinder-piston arrangement for the fluid actuation of said slide, and conduit means leading into said chamber for supplying pressure fluid thereto.



7. In a hydrodynamic torque converter, a stationary converter housing, a rotating pump wheel, a rotating turbine wheel and guide wheel blading connected to the converter housing, an annular slide adapted to be moved axially into the fluid chamber into the path of fluid movement and guided outside the fluid chamber in the converter housing whereby said slide is operable for throttling or interrupting fluid flow in the converter and thereby the power flow therein, guide blades arranged stationarily in an annular path on said converter housing and arranged in the immediate vicinity of the annular slide so the guide blade edges facing the annular slide are evenly spaced from the axis of the converter and are flush with a concentric wall surface of the annular slide so as to form guiding means for the annular slide when it is moved inwardly into the converter, said converter housing having an annular chamber receiving the annular slide and forming therewith a cylinder-piston arrangement for the fluid actuation of said slide, and conduit means leading into said chamber for supplying pressure fluid thereto, said conduit means being connected to said chamber at points uniformly spaced thereabout, a source of fluid under pressure, and the individual conduit means leading from said source of fluid to said points being about equal in length.

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