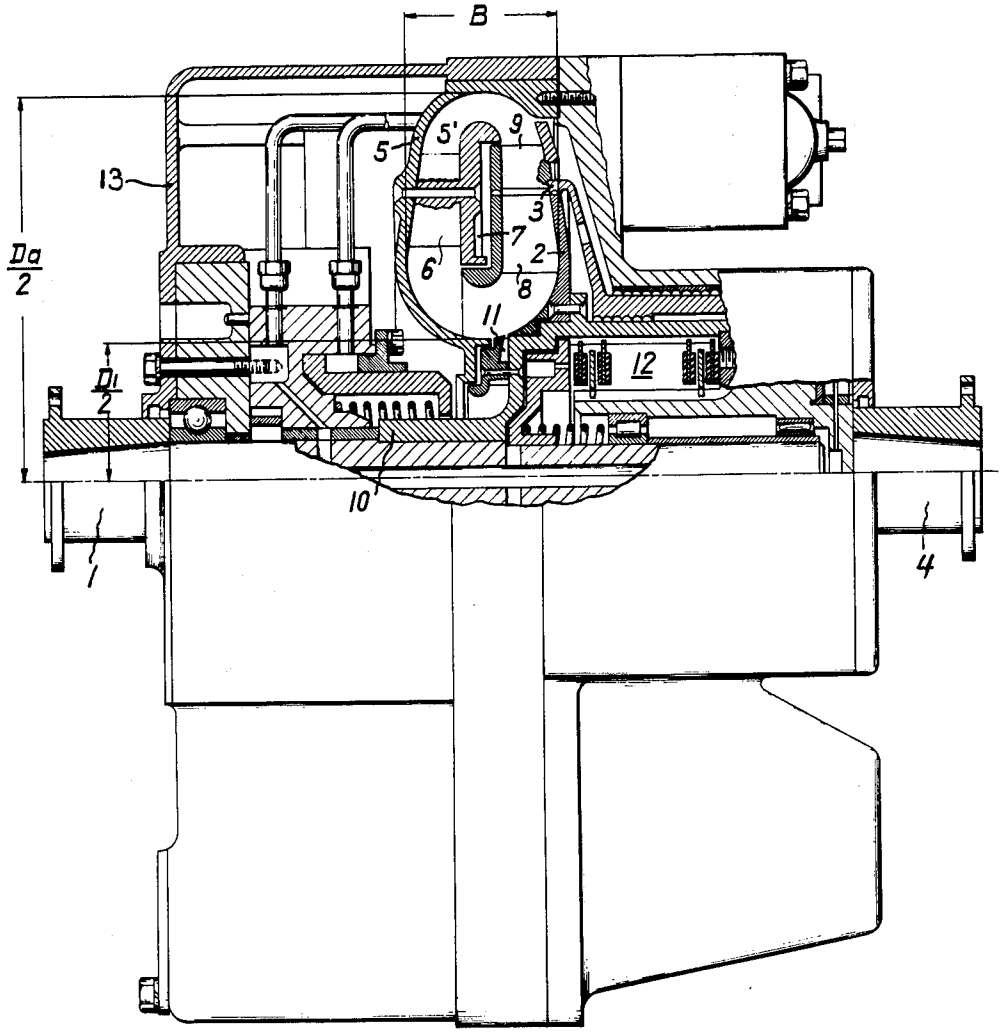
July 19, 1966 H. VÖLKER ETAL 3,261,166

CONVERTER

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Fig. 1



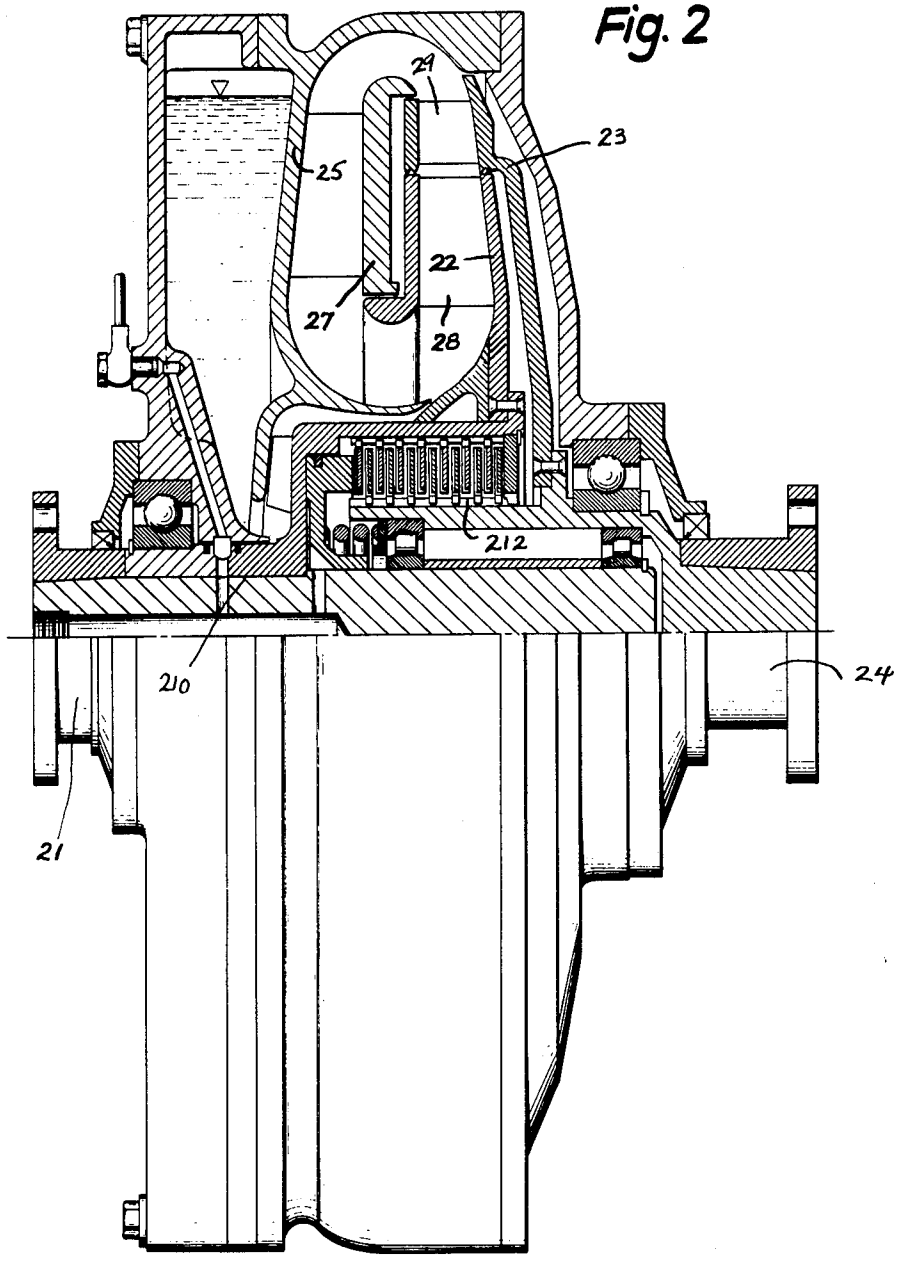
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Fig. 2



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3,261,166

CONVERTER

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10 Claims. (Cl. 60—54)

The present invention relates generally to the torque converter art, and, more particularly, to a Foettinger converter which is extraordinarily short and compact.

It is already known to locate a sump and pressure maintaining means for moving the hydraulic medium into the working chamber in the hub casing and laterally of the working chamber of such hydraulic transmission units. However, in such units it is not possible to arrange these means within the inner diameter of the toroidal or annular working chamber in order to avoid an increase of the total length of the converter.

Also known are means for providing a driving connection of the pump wheel and turbine wheel in the hub casing and laterally of the working chamber. The use of positively operating by-pass couplings within the inner diameter of the working chamber although conventional are disadvantageous because the parts which are to be coupled must be synchronized before the coupling takes place. The positively connected or force-locked operating by-pass couplings are positioned laterally of the working chamber so that they tend to increase the total length of the converter.

With this prior art in mind it is a main object of the present invention to provide a converter which possesses a small annular working chamber volume so that even with the use of a small sump pump capacity rapid filling of the working chamber can take place.

Another object of the invention is to provide a converter of the character described wherein the transmission ratio and the power consumption will not be worse or smaller than in conventional converters which are provided with the same outer diameter but have much larger outer dimensions otherwise and larger flow passage cross sections.

Still another object of the invention is to provide a converter wherein the axial passages of the converter which provide for hydraulic flow are shortened in order to reduce the losses caused by friction.

Yet another object of the invention is to provide a device of the character described which eliminates the disadvantages of prior art devices as set forth above.

These objects and others ancillary thereto are accomplished in accordance with preferred embodiments of the invention wherein a Foettinger converter is provided having an annular working chamber which is the chamber where the transfer of power takes place between the pump blades and the turbine blades. The maximum width or axial length of the working chamber is 20 percent of the outer diameter of this chamber and the minimum inner diameter is 35 percent of the outer diameter. Utilizing these proportions provides that the blades are positioned on a relatively large radius and are therefore particularly effective.

The sump pump in the present invention is disposed within the hub casing and a driving connection of the pump wheel and turbine wheel is provided in the hub of the casing by means, for example, of a direct drive friction clutch.

Additional objects and advantages of the present invention will become apparent upon consideration of the following description when taken in conjunction with the accompanying drawings in which:

FIGURE 1 is a partial sectional view through one embodiment of the present invention.

FIGURE 2 is a partial sectional view through another embodiment of the invention.

With more particular reference to the drawing it should be noted that in FIGURE 1 an outer casing **13** is provided and a drive shaft **1** is disposed at the left side while a driven shaft **4** is provided on the right side thereof. Within outer casing **13** is a fixed converter housing **5** which is actually the housing for the working chamber **5'**.

A converter pump wheel **2** is connected to a hub **10** which is mounted to drive shaft **1**. The hydraulic fluid which is accelerated by pump **2** by means of its blade **8**, streams in the converter working chamber **5'** and drives the turbine **3** of the converter by causing the hydraulic fluid to move against the turbine blades **9**. This turbine wheel **3** is mounted on the drive shaft **4**.

Within the working chamber **5'** the pump blades **8** are provided for streaming a liquid against the turbine blades **9**. Also provided is a reaction member in the form of guiding blades **6** which are connected to the fixed housing **5** to provide smooth conditions of flow from the initial direction at the inlet of the pump **2**.

In accordance with the present invention the converter working chamber which is annular is so formed that its width or axial length B is less than or equal to 20 percent of the outer diameter D*a*, and the inner diameter D*i* is greater than or equal to 35 percent of the outer diameter D*a*. By this means the otherwise unutilized core space of the converter is eliminated and the only part remaining of this is a flat core disc **7**.

From the embodiment of the present invention as set forth in FIGURE 1 it can be seen that in the converter of the present invention all of the blades, that is the pump blades **8**, the turbine blades **9**, and the guide or control blades **6**, are disposed on a very large radius so that they have a high circumferential speed even at low drive r.p.m. of the pump wheel **2** and they thereby become effective as a power transmission. Therefore the otherwise conventional high gear drive before the drive shaft **1** can be eliminated.

The construction of the present invention permits the arrangement of the sump and pressure maintaining pump **11** on the drive shaft **1** at or in the pump hub **10**. A special drive for the pump is not necessary so that power transmission elements such as chain and gear drives which are susceptible to trouble and which normally are necessary and which would enlarge the dimensions of the converter in an undesirable manner, can be omitted.

In FIGURE 1 the converter of the present invention is shown which has a by-pass coupling **12** in addition to the sump and pressure maintaining pump **11** installed in the pump hub **10**. This means the drive shaft **1** and the driven shaft **4** can be coupled to each other directly by by-passing the converter. In accordance with the present invention it is possible to install this coupling in the converter without increasing the total length thereof. This coupling **12** is positioned between the pump hub **10** and the drive shaft **4**.

This installation is only possible because by observing the proportions set forth in accordance with the present invention there is sufficient space available within the center of the converter working chamber which is annular.

Thus, FIGURE 1 illustrates a converter having a sump and pressure maintaining pump for the working chamber as well as means providing a driving connection of the pump wheel and turbine wheel in the hub casing. The sump and pressure maintaining pump is positioned within the inner diameter of the annular working chamber. It is also possible to arrange the means for providing a driving connection of the pump wheel and turbine wheel

within the inner diameter of the annular working chamber and such could take the form, for example, of a positive operating by-pass coupling as shown in FIGURE 2.

FIGURE 2 is an embodiment of the invention in which the means for drivingly connecting the pump wheel and the turbine wheel is disposed within the inner diameter of the annular working chamber. In the embodiment illustrated, this means is a positively operating multiple disc clutch operated by oil pressure and made effective by an automatic control device (not shown) when the secondary moment is equal to the primary moment. Elements in FIGURE 2 which are similar to those of FIGURE 1 are identified with similar reference numerals, but preceded by "2".

It should thus be noted that in the converter of the present invention it is possible to arrange means for a driving connection of the pump wheel and turbine wheel in the hub casing so that the length of the converter is not increased by this installation. It is also possible to place the sump and pressure maintaining means in the hub casing of the converter. This, too, does not contribute to an increase in the total length of the converter. Thus, the converter constructed in accordance with the present invention with all of the auxiliary assemblies consequently forms a compact, extremely short arrangement whereas in the conventional converter arrangements the auxiliary assemblies are annexed to the actual converter and unnecessarily enlarge its dimensions.

The sump pump in the conventional arrangements is particularly very susceptible to trouble because it is driven via chain or gear drives so that the sump pump necessarily has to be positioned on the outside of the converter in order to provide easy accessibility. In the present invention, however, this problem is solved in a simple manner by positioning the sump pump in the hub of the converter to rotate with it. Intermediate gearing and drives which are susceptible to trouble are thus eliminated.

According to the present invention certain proportions for the working chamber are set forth and adhering to these proportions provides that all of the blades of the converter will be positioned on a very large radius and will therefore be particularly effective. On the other hand this makes it possible to eliminate the high gear drive (transmission gear) for producing the circumferential speed necessary for power transmission. Furthermore, the unutilized core space is practically eliminated and the only portion thereof remaining is a flat core disc.

It will be understood that the above description of the present invention is susceptible to various modifications, changes, and adaptations, and the same are intended to be comprehended within the meaning and range of equivalents of the appended claims.

What is claimed is:

1. In a torque converter having sump and pressure maintaining means for the annular working chamber thereof and means for firmly connecting the pump wheel and the turbine wheel, the improvement wherein the width of the working chamber is not more than 20 percent of the outer diameter of the working chamber and the inner diameter of the working chamber is not less than 35 percent of the outer diameter.

2. A torque converter, comprising, in combination:
(a) a pump wheel;

(b) a turbine wheel;
(c) means defining an annular working chamber in which a hydraulic fluid impelled by the pump wheel drives the turbine wheel, the width of the working chamber being not more than 20 percent of the outer diameter of the working chamber and the inner diameter of the working chamber being not less than 35 percent of the outer diameter;
(d) sump means associated with the annular chamber; and
(e) means for drivingly connecting the pump wheel and turbine wheel.

3. A torque converter, comprising, in combination:
(a) a pump wheel;
(b) a turbine wheel;
(c) means defining an annular working chamber in which a hydraulic fluid impelled by the pump wheel drives the turbine wheel, the width of the working chamber being not more than 20 percent of the outer diameter of the working chamber and the inner diameter of the working chamber being not less than 35 percent of the outer diameter;
(d) sump and hydraulic pressure maintaining means for the annular chamber; and
(e) means for drivingly connecting the pump wheel and turbine wheel.

4. In a converter, the combination which comprises:
(a) a pump wheel;
(b) a turbine wheel;
(c) means which together with said wheels define an annular working chamber in which a hydraulic fluid impelled by the pump wheel drives the turbine wheel, the maximum axial length of the working chamber being 20 percent of the outer diameter thereof and the minimum inner diameter being 35 percent of the outer diameter;
(d) means for filling the working chamber with hydraulic fluid and for maintaining the presure therein; and
(e) means for drivingly connecting the pump wheel and turbine wheel.

5. The combination defined in claim **4** wherein at least one of said wheels has a hub casing and the connecting means is disposed within the inner diameter of the annular working chamber in the hub casing.

6. The combination defined in claim **5** wherein the connecting means is a positively operating by-pass coupling.

7. The combination defined in claim **4** wherein at least one of said wheels has a hub casing, and the filling means is in the hub casing within the inner diameter of the annular working chamber.

8. The combination defined in claim **4** wherein at least one of said wheels has a hub casing, and the connecting means and filling means are in the hub casing.

9. The combination defined in claim **8** wherein the connecting means is disposed within the inner diameter of the annular working chamber.

10. The combination defined in claim **8** wherein the filling means is disposed within the inner diameter of the annular working chamber.

No references cited.

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