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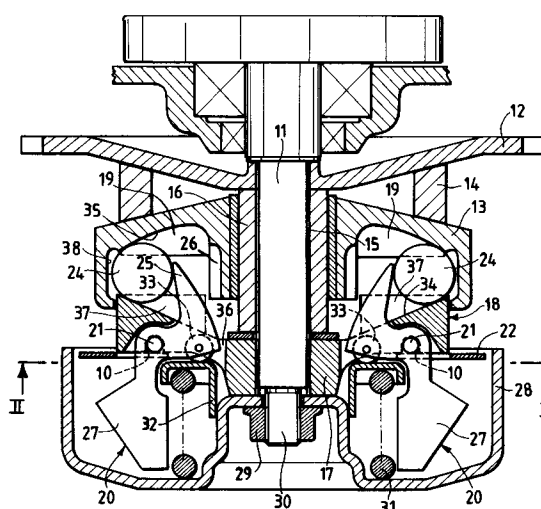
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(54) **Drive pulley unit in pedal vehicles with stepless transmission comprising an automatic device for facilitating starting.**

(57) In pedal vehicles with stepless transmission, a drive pulley unit comprising an automatic device for facilitating starting, in which the drive pulley comprises a pair of half pulleys (12, 13) mounted on a shaft (11), the first (12) being axially fixed and the second (13) being axially movable relative to the first, between the two half pulleys there being positioned a drive belt (14) engaging against walls of the two half pulleys (12, 13), which depending on their distance apart determine low gear or high gear, associated with the drive pulley unit there being provided a gear position regulator consisting of a counteracting element (18) associated with the movable second half pulley (13) via radially movable rolling bodies (24) inserted in respective housings (19, 37), wherein to the counteracting element (18) there are connected radially oscillable centrifugal masses (20) which are associated with an elastic element (31) and interact with the rolling bodies (24) at low speeds to cause the half pulleys (12, 13) to assume a position of maximum approach, determining high gear.

Fig.1

This invention relates to a drive pulley unit in pedal vehicles with stepless transmission comprising an automatic device for facilitating starting.

One of the main fields of application of a stepless transmission in the form of expandable pulleys for V-belt operation is in two-wheel vehicles of small cubic capacity. This is mainly for reasons of practicality of use, constructional simplicity and economy of implementation.

In this respect the transmission performs its function by simply varying the belt winding diameters on the pulleys. In general there is associated with the drive pulley unit an rpm regulator formed from rolling bodies, generally rollers, which are arranged between a movable half pulley and an opposing element keyed onto the drive shaft. The driven pulley unit can be formed for example from two half pulleys and a counteracting spring in the presence of an automatic dry centrifugal clutch.

Moreover on motorized two-wheel vehicles, such as mopeds of the most economical type, the pedals assume additional functions.

Besides the usual function of foot rests and auxiliary elements for driving the vehicle by pedalling, the pedals are used for starting the engine. In this case movement is transmitted from the pedal axis to the drive wheel by the chain, whereas from the wheel axis to the engine the components designed for power transmission are used, ie the reduction gear and the speed change gear.

This system of operation, which has its advantages in system simplicity and economy, imposes design constraints for automatic transmission. This derives from the fact that during engine stoppage, the transmission automatically assumes low gear with low ratio. Consequently the choice of a very reduced low ratio, combined with optimum pedal stroke development, can make starting difficult because during starting, the entire system has to step up.

In an attempt to solve this problem and provide a starting system with an acceptable load on the pedals, a transmission with modest ratio variation is used. This is combined with a very low pedal stroke ratio, and in addition a decompression valve is mounted on the cylinder head for operation during starting.

When however greater performance is required in terms of pickup and acceleration, transmissions with a large ratio variation (range > 2) are implemented. The aforesaid system can then not be used, and systems such as electrical starting used instead, these being little suitable for a moped and decidedly more costly.

The object of the present invention is to provide a drive pulley unit in pedal vehicles with stepless transmission which is provided with an automatic device for facilitating starting which is

easier to use and requires minimum force, while being of simple and relatively low-cost construction.

The object is attained according to the present invention by providing, in pedal vehicles with stepless transmission, a drive pulley unit comprising an automatic device for facilitating starting in which said drive pulley comprises a pair of half pulleys mounted on a shaft, the first being axially fixed and the second being axially movable relative to the first, between said two half pulleys there being positioned a drive belt engaging against facing walls of said two half pulleys, which depending on their distance apart determine low gear or high gear, associated with said drive pulley unit there being provided a gear position regulator consisting of a counteracting element associated with said movable second half pulley via radially movable rolling bodies inserted in respective housings, characterised in that to said counteracting element there are connected radially oscillable centrifugal masses which are associated with an elastic element and interact with said rolling bodies at low speeds to cause said half pulleys to assume a position of maximum approach, determining high gear.

A unit provided with this device enables a pedal starting system to be maintained even for automatic transmission with a larger operating range and hence with better performance. This is because it provides a softer transmission ratio with reduced force on the pedals.

The characteristics and advantages of a drive pulley unit in pedal vehicles with stepless transmission comprising an automatic device for facilitating starting according to the present invention will be more apparent from the detailed description given hereinafter by way of non-limiting example with reference to the accompanying schematic drawings, in which:

Figure 1 is a section on the line I-I of Figure 2 through a drive pulley unit in pedal vehicles with stepless transmission comprising an automatic device for facilitating starting according to the present invention in a first position for engine stoppage;

Figure 2 is a section on the line II-II of Figure 1 showing a counteracting roller, and with a mass shown partially sectioned;

Figure 3 is a sectional view similar to Figure 1 in a second position with the engine operating;

Figure 4 is a section through a detail on the line IV-IV of Figure 2 showing the fixing, by means of a disc, of the pins about which the centrifugal masses oscillate;

Figure 5 is a sectional detail similar to Figures 1 and 3 showing a second embodiment of part of the drive pulley unit with the device according to

the invention; and

Figures 6 and 7 are plan views of the two regulator elements taken from above and from below.

The drawings show schematically a drive pulley unit in pedal vehicles with stepless transmission comprising an automatic device for facilitating starting, according to the present invention.

It can be seen that the automatic device is mounted on the drive pulley unit according to the invention to cause the half pulleys to move into the high gear position during engine stoppage, ie with maximum mutual approach of the two constituent half pulleys of the drive pulley unit.

Specifically, the drawings show that the drive pulley unit with the device is arranged on an extension 11 of the drive shaft, not shown. The drive pulley unit comprises a pair of half pulleys 12 and 13, the first 12 being mounted axially fixed and the second being axially movable along the axis of the shaft extension 11 relative to the first half pulley 12. Between the two half pulleys 12 and 13 there is positioned a drive belt 14 which engages against the facing walls of the half pulleys 12 and 13, which depending on their distance apart determine low gear or high gear.

The shaft extension 11 is externally toothed at 15, on this toothing there being located a bush 16 retained, via a washer, by a nut portion 17 provided centrally within a counteracting spoke element 18 forming part of the transmission regulator. The counteracting element 18 is connected to the half pulley 13 by a series of rolling bodies such as rollers 24, positioned within a series of housings provided in the facing elements. Housings or cavities 19 are provided in the half pulley 13 and complementary housings or cavities 37 are provided in the counteracting element 18. As the half pulley 13 and counteracting element 18 are radially constrained by the interposed rollers 24 there is improved torque transmission, the counteracting element 18 being keyed onto the shaft extension 11.

Centrifugal masses 20 are located through apertures 36 in the counteracting element 18 in correspondence with the cavities 37. The masses 20 can oscillate about pins 21 located in relative seats 10 provided in the bottom of the counteracting element 18 laterally to the apertures 36. The pins 21 are maintained in position by a disc element 22 by means for example of a set of three positionable screws 23 rigid with the counteracting element 18.

Between the centrifugal masses 20 and rounded portions 35 of that inner surface of the profiled half pulley 13 facing each cavity 19 there are inserted, as stated, the rollers 24 such that they also become partly inserted into the housings 37,

to determine mutual interaction between the parts. In this respect, the masses 20 are of S shape and are located within the through apertures 36 provided in the counteracting element 18. Each of the masses has a first end 25 which can be inserted without contact into a relative seat 26 provided in the central hub of the half pulley 13. The second end 27 represents the actual mass which when under rotation moves radially outwards, oscillating within a cap-shaped containing element 28. This latter element 28 is positioned rigid with the end of the extension 11 and is locked thereat by a nut 29 on a threaded part 30. The through apertures 36 are shaped to enable the masses to move from one position to the other and vice versa during their oscillation. The limit stops for the masses 20 are formed respectively by the cap-shaped containing element 28 and the rollers 24 which are urged by the masses into contact with the limiting inner cylindrical portion 38 of the half pulley 13.

Between the cap-shaped containing element 28 and the rear side of the first end 25 of the masses 20 there is positioned a spring 31 with an interposed cup 32. On the cup 32 there also act a series of counteracting elements 33 such as rollers or balls, housed in or rotatably arranged on the masses 20 to facilitate movement between the parts by eliminating possible jamming and wear.

To facilitate the mounting of the device of the invention in a drive pulley unit, the regulator unit comprising essentially the masses 20, pins 21, counteracting rollers 33 and counteracting element 18 is preassembled by the use of the relative disc 22 and screws 23.

Figure 5 shows an alternative embodiment in which the counteracting rollers or balls 33 are dispensed with and the lower side of the first end 25 of the mass 20 acts directly on the cup 32.

As in the preceding case the rollers 24 are retained in the housings 19 and 37 of the movable half pulley 13 and of the counteracting element 18, and slide along inclined surfaces 34 on the base of the housings 37 in the counteracting element 18.

It is apparent that during engine stoppage the drive pulley unit with the automatic device according to the invention locates the half pulleys 12 and 13 in their high gear position, ie with the half pulleys in their position of maximum approach. In this respect the masses 20 urged by the spring 31 and by the cup 32 shift the regulator rollers 24 outwards into the housings 19 and 37 respectively, by sliding on the inclined surfaces 34.

During starting, as the engine rpm increases, the masses 20 rotate about the pins 21 by the effect of centrifugal force, their second end 27 moving radially outwards. In this manner the spring 31 is compressed until the second ends 27 of the masses halt against the cap-shaped containing ele-

ment 28. This therefore results in a low gear arrangement, the automatic device for facilitating starting in pedal vehicles with stepless transmission according to the invention coming into operation at relatively low rpm without interfering with the operation of the transmission regulator with which it is correlated. As the rpm increases, the rollers 24 again rise along the inclined surfaces 34 to achieve an appropriate high gear arrangement.

By using in a pedal vehicle with stepless transmission a drive pulley unit comprising an automatic device for facilitating starting in accordance with the present invention, an optimum transmission ratio for pedalling can be used, with a pedal stroke development adequate for the vehicle.

The decompression valve or device on the cylinder head can advantageously be dispensed with, leading to undoubted advantages.

In this respect, increased constructional simplicity with improved engine performance and efficiency are achieved, as the spark plug can be positioned without being influenced by the construction.

Claims

1. In pedal vehicles with stepless transmission, a drive pulley unit comprising an automatic device for facilitating starting, in which said drive pulley comprises a pair of half pulleys (12, 13) mounted on a shaft (11), the first (12) being axially fixed and the second (13) being axially movable relative to the first, between said two half pulleys there being positioned a drive belt (14) engaging against facing walls of said two half pulleys (12, 13), which depending on their distance apart determine low gear or high gear, associated with said drive pulley unit there being provided a gear position regulator consisting of a counteracting element (18) associated with said movable second half pulley (13) via radially movable rolling bodies (24) inserted in respective housings (19, 37), characterised in that to said counteracting element (18) there are connected radially oscillable centrifugal masses (20) which are associated with an elastic element (31) and interact with said rolling bodies (24) at low speeds to cause said half pulleys (12, 13) to assume a position of maximum approach, determining high gear.
2. A drive pulley unit as claimed in claim 1, characterised in that said elastic element is a spring (31) arranged to determine said mutual position of said half pulleys (12, 13) at low speeds.
3. A drive pulley unit as claimed in claim 1, characterised in that said rolling bodies (24) are rollers.
4. A drive pulley unit as claimed in claim 1, characterised in that each of said masses (20) can oscillate about pins (21) positioned in seats (10) provided in said counteracting element (18), a disc (22) being provided to retain said pins (21) in position.
5. A drive pulley unit as claimed in claim 4, characterised in that said disc (22) is fixable to said counteracting element (18) by screws (23).
6. A drive pulley unit as claimed in claim 1, characterised in that said centrifugal masses (20) are of S shape, a first end (25) of said S shape engaging on said rolling bodies (24), the second end (27) forming the actual mass and facing radially outwards.
7. A drive pulley unit as claimed in claim 1, characterised in that said housings (19) provided in the inner surface of said half pulley (13) are shaped with rounded portions (35) which interact with said series of rolling bodies (24).
8. A drive pulley unit as claimed in claim 1, characterised in that inclined surfaces (34) are provided on the inwardly facing part of said counteracting element (18) within said housings (37), to form slide surfaces for said rolling bodies (24).
9. A drive pulley unit as claimed in claim 2, characterised in that said counteracting element (18) is connected to said shaft (11) by a toothed connection (15, 17), said spring (31) for determining said mutual position of said half pulleys (12, 13) at low speeds being maintained in position within a cap-shaped containing element (28) connected to said shaft (11) by a threaded connection (29, 30).
10. A drive pulley unit as claimed in claim 2, characterised in that said spring (31) is contained at its top in a cup (32) on which rear parts of a first end (25) of said masses (20) act.
11. A drive pulley unit as claimed in claim 10, characterised in that said rear part of said first ends (25) of said masses (20) houses a series of counteracting elements (33) acting on said cup (32).

Fig.1

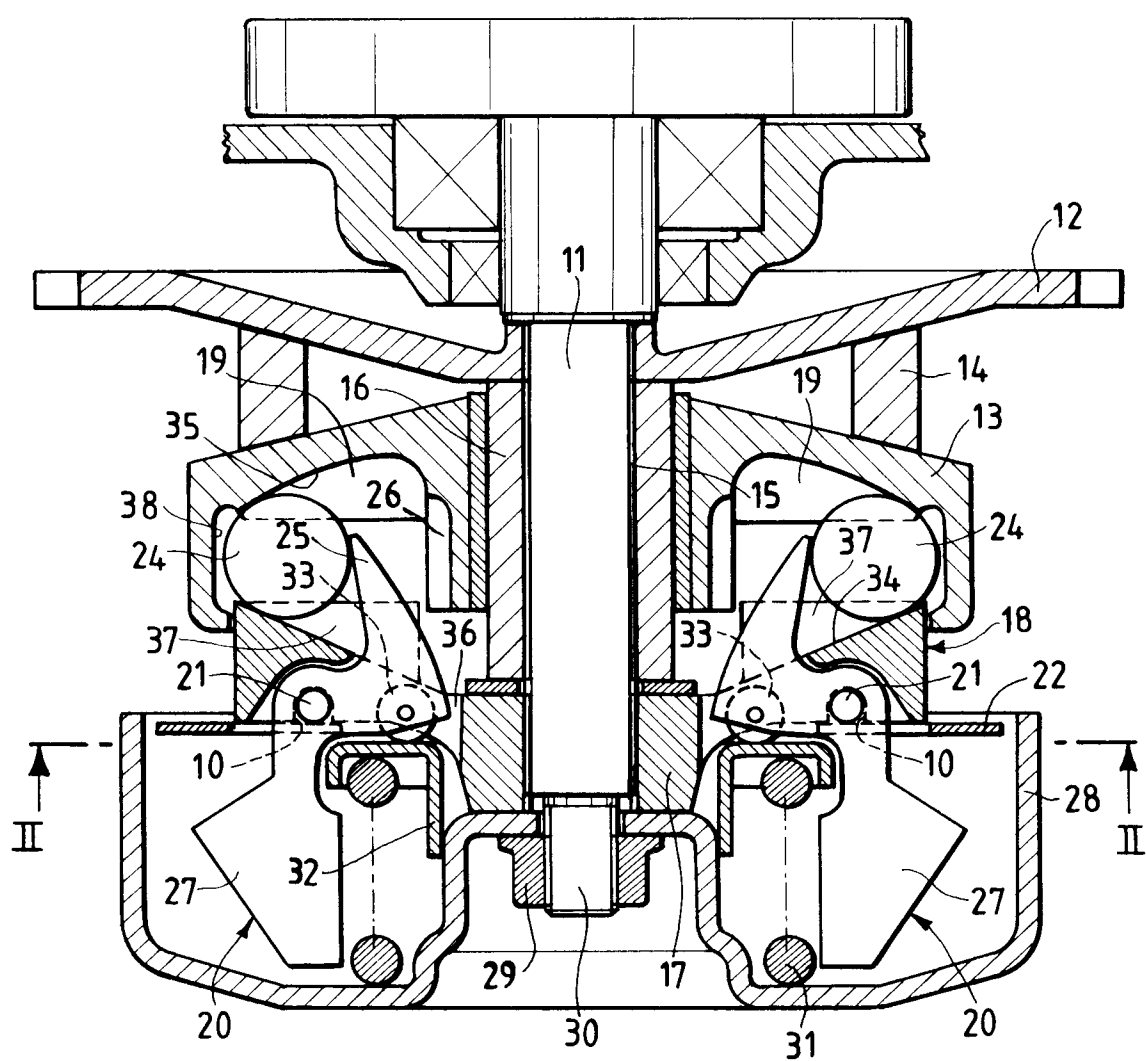


Fig.2

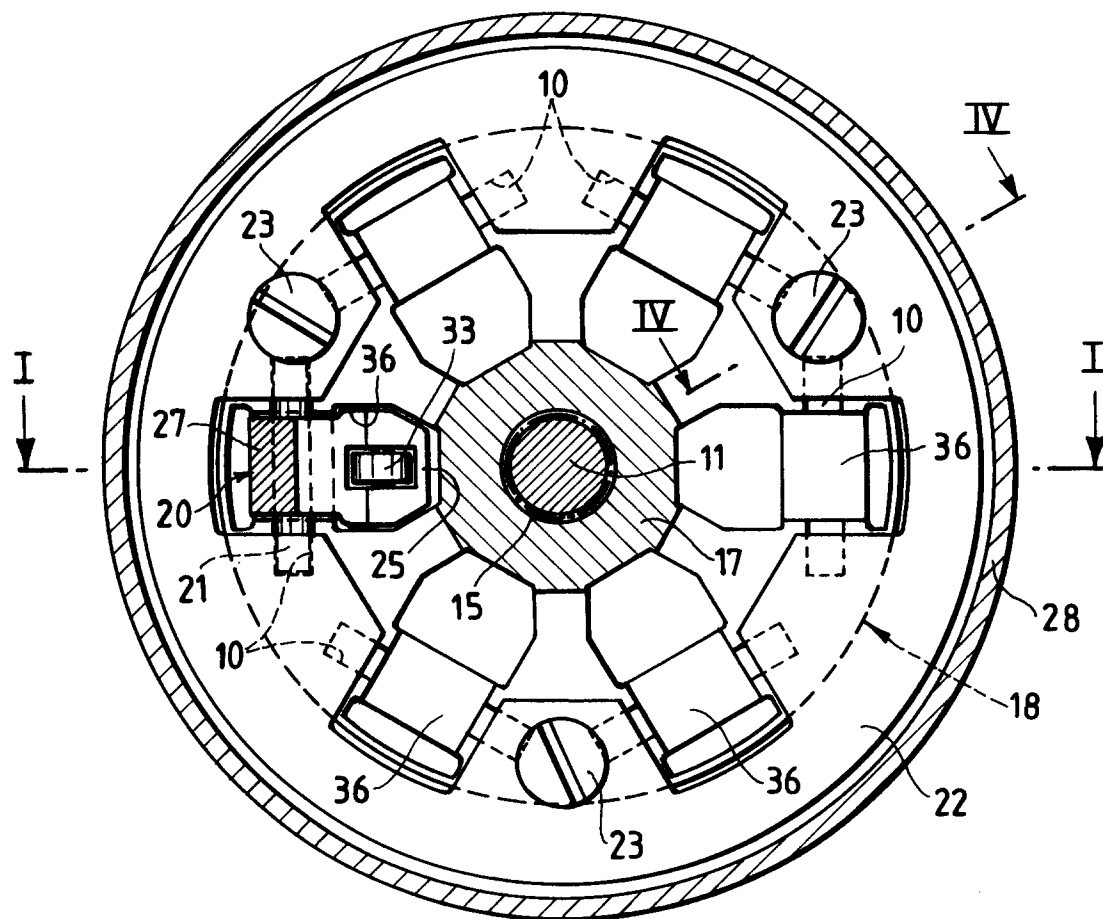
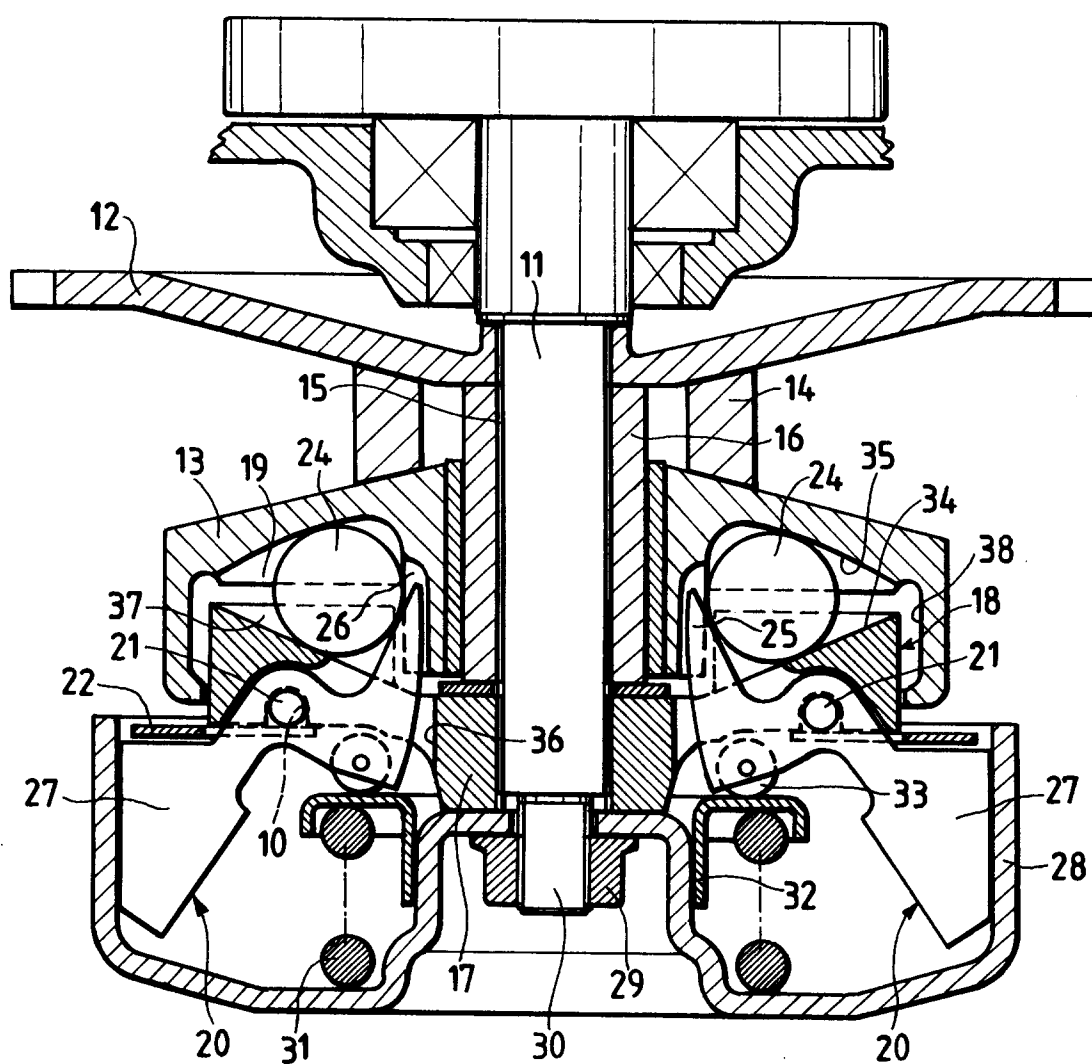


Fig.3



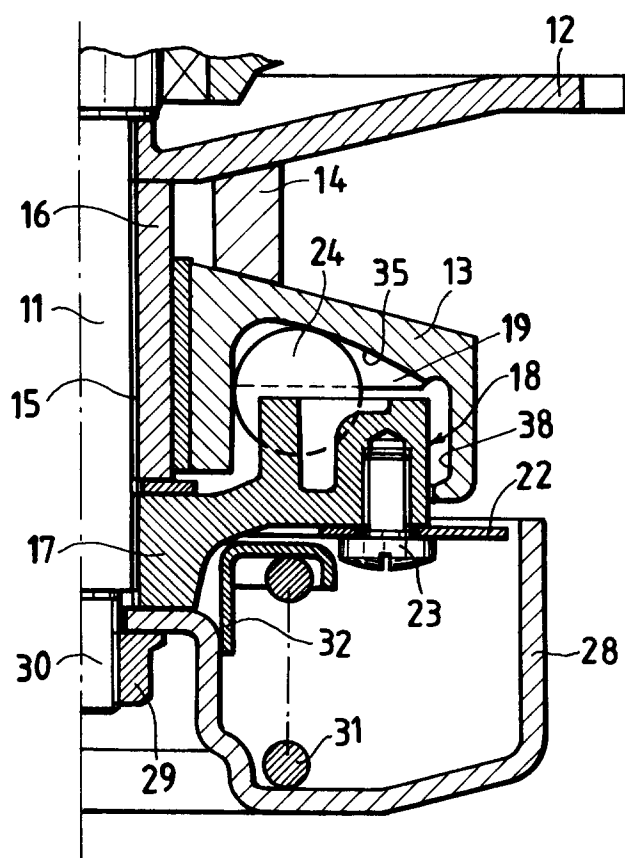


Fig.4

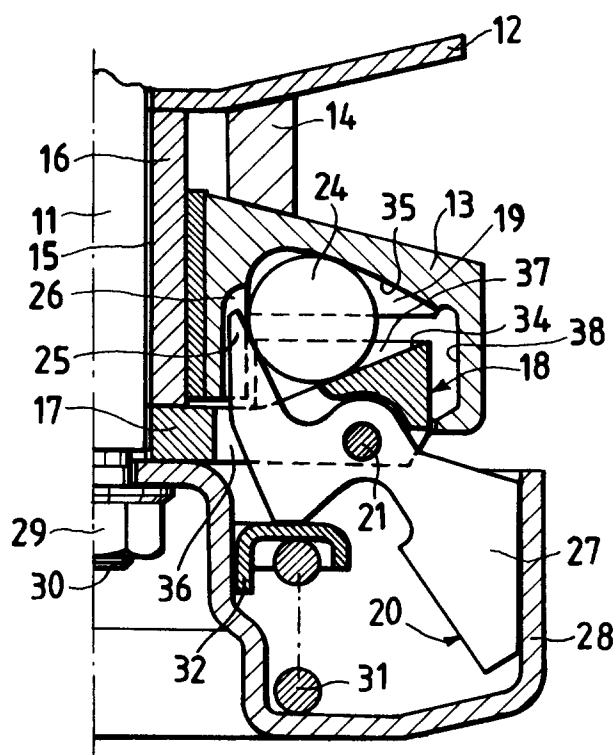


Fig.5

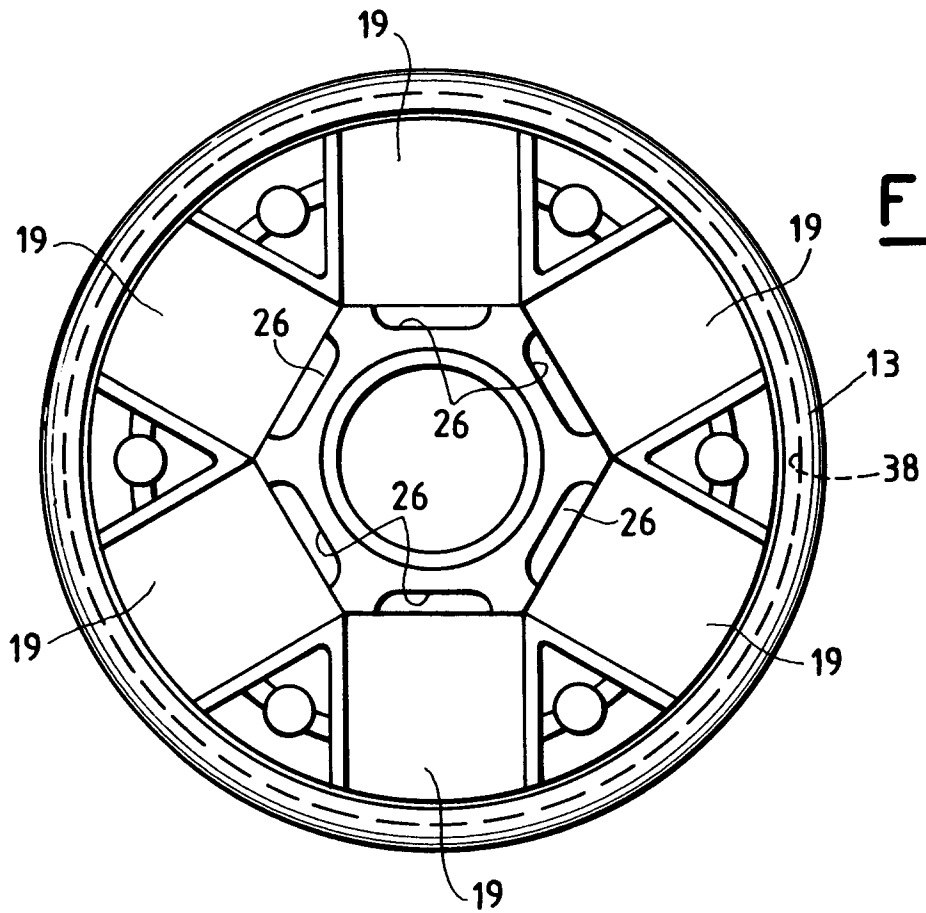


Fig. 6

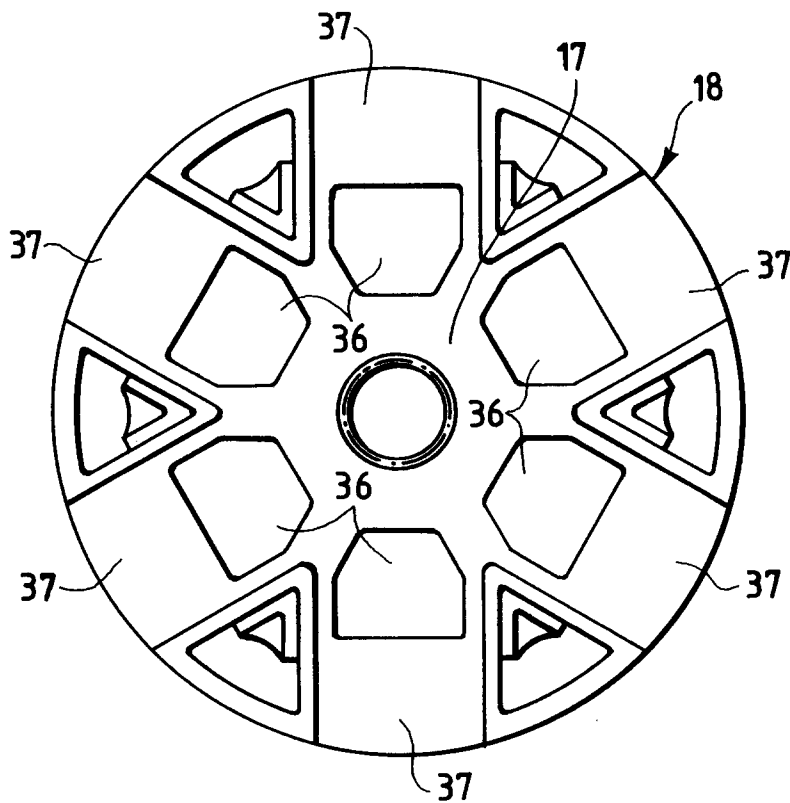


Fig. 7



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EUROPEAN SEARCH REPORT

Application Number
EP 95 20 0741

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	DE-B-10 01 901 (SUDD. ILO WERK) * column 3, line 27 - line 42 * * column 5, line 28 - line 38; figure 1 * ---	1,3,8	F02N3/04
A	NL-C-105 358 (ROCKWELL) * claim; figure 2 * -----	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B62M F02N
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 26 July 1995	Examiner Van der Wal, W
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			