

12 **EUROPEAN PATENT APPLICATION**

21 Application number: 85111174.0

51 Int. Cl.⁴: **D 06 F 37/36, F 16 H 11/06**

22 Date of filing: 04.09.85

30 Priority: 17.09.84 IT 4572284

71 Applicant: **Zanussi Elettromeccanica S.p.A., Via Giardini Cattaneo 3, I-33170 Pordenone (IT)**

43 Date of publication of application: 26.03.86
Bulletin 86/13

72 Inventor: **Rizzetto, Pietro, Via Allende 59, I-30029 San Stino di Livenza Venezia (IT)**
Inventor: **Regazzo, Olindo, Via Gasparinetti 5, I-31100 Treviso (IT)**

84 Designated Contracting States: **AT BE CH DE FR GB IT LI LU NL SE**

74 Representative: **Patentanwälte Grünecker, Kinkeldey, Stockmair & Partner, Maximilianstrasse 58, D-8000 München 22 (DE)**

54 **Speed variator for laundry washing machine.**

57 A speed variator for a laundry washing machine comprising a drum (6) mounted for rotation in a laundering tub (5) and adapted to be rotated at different speeds by a motor (7) via a transmission belt (8) interconnecting a driving pulley (9) of motor (7) and a driven pulley (10) associated with the drum. The driving pulley (9) of the speed variator is of the variable-diameter type and cooperates with a number of radially expandable flyweights (14).

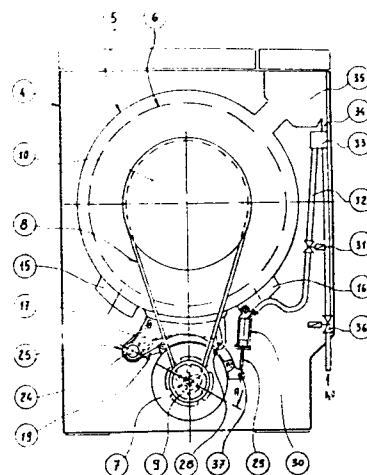
The driving pulley (9) and the motor (7) are carried by a rotatable carrier arm (19) having one of its ends hingedly connected to a lower portion of the tub (5), while its other end is connected to a piston (29) mounted for reciprocating displacement to different operating positions in a cylinder (39) connected through a solenoid valve (31) to the water supply circuit of the machine.

The carrier arm (19) is biased by a torsion spring (25) to a position in which the driving pulley (9) is effective to keep the belt (8) under tension against the action caused by the radial expansion of the flyweights (14).

The piston (29) acts on the carrier arm (19) in a manner to interdict or to permit the radial expansion of the flyweights (14) to varying degrees depending on the respective position of the piston.

As a result, the effective diameter of the driving pulley (9)

is varied by different degrees, permitting the drum (6) to be rotated at variable speeds.



1 Description

The present invention relates to a speed variator for a laundry washing machine for permitting the drum thereof
5 to be rotated at different speeds.

In conventional laundry washing machines, the transmission of the driving force from an electric motor of the commut-
able pole type to the drum, for rotating the latter at
laundrying and centrifuging speeds, is accomplished by
10 means of a V-belt interconnecting respective pulleys asso-
ciated with the motor and the drum.

The drum may additionally be rotated at a further speed lying between the laundrying and centrifuging speeds for
15 executing particular laundrying steps, for instance for
establishing the dynamic equilibrium of the drum or for
carrying out the centrifuging operation at a reduced speed.

To this purpose, the motor may advantageously cooperate with suitable speed variator means operable to rotate the
20 drum at a variable transmission ratio. Known constructions of this type include an electromechanic speed variator comprising a variable-diameter pulley cooperating with a fork member hinged at one end to the housing of the motor of the machine and connected at its other end to a spring-
25 biased pull member adapted to be actuated by a solenoid under the control of the program unit of the machine.

Energization of the solenoid causes the fork member to be arcuately displaced about its hinged connection with the
30 motor housing to thereby vary the effective diameter of the pulley.

As a result, the transmission belt for rotating the drum is shifted to a different diameter of the driving pulley, so
35 that the drum is further rotated at a different transmission ratio.

A speed variator of this type is of complicated and bulky

- 1 construction while its operation is not sufficiently reliable due to the employ of the solenoid which requires an excessive amount of electric power and is readily affected by failure or by a tendency to faulty operation.
- 5 Other known speed variators for laundry washing machines include at least one variable-diameter driving pulley cooperating with a number of radial-expansion flyweights, and at least one tension roller biased by a spring into
- 10 engagement with the transmission belt for rotating the drum and operatively connected to a hydraulic or oleo-dynamic piston mounted for reciprocating displacement in an associated cylinder connected via at least one solenoid valve to the water supply circuit of the machine, said solenoid
- 15 valve being adapted to be automatically energized and de-energized under the control of the program unit of the machine.
- The amount of water or other liquid supplied to the cylinder in the manner described thus determines the displacement of the piston and accordingly, of the tensioning
- 20 roller to various operating positions relative to the V-belt so as to bias the tensioning roller into engagement therewith with a variable compressive force.
- 25 For rotating the drum of the machine at the laundering and final centrifuging speeds, respectively, the motor is switched from its low speed to its high speed, while the water or other liquid previously supplied to the cylinder is discharged therefrom to thereby interdict and then to
- 30 permit the radial expansion of the flyweights of the speed variator. It is finally possible to rotate the drum at intermediate speeds between the laundering and centrifuging speeds and depending on the rotational speed of the motor, by progressively displacing the piston, and thus
- 35 the tensioning roller, to different positions relative to the V-belt in the manner described above.

Speed variators of this type operate in a satisfactory man-

ner, they suffer from the disadvantage, however, that the tensioning roller acting on the V-belt tends to set up vibrations in the entire machine, whereby the operation thereof becomes rather noisy.

5 In addition, the continuous action of the tensioning roller on the V-belt may result in elastic elongation of the belt, so that the actual rotational speed of the drum drops below the rated speed, requiring manual adjustments of the driving
10 and/or driven pulleys to be carried out for re-establishing the correct belt tension.

It is an object of the present invention to eliminate the disadvantages and shortcomings of the known embodiments described by providing a speed variator of simple construct-
15 ion and reduced dimensions, said speed variator having at least one variable-diameter pulley cooperating with radially expandable flyweights, and at least one hydraulic or oleodynamic piston of the type described, said piston being not, however, provided with a tensioning roller in the
20 present case while being operable to determine the rotation of the drum of the machine at different speeds in a manner different from the one described above.

A speed variator of this type is characterized in that the
25 motor of the machine, together with the variable-diameter pulley, is carried by at least one hinged arm of a suitable configuration having one of its ends hinged to a lower portion of the laundering tub, while its other end is connected to said piston, said arm being biased by at least one tors-
30 ion spring in a direction in which said variable-diameter pulley tends to keep said transmission belt under tension.

In this manner, the transmission belt can be shifted to different diameters of the variable-diameter pulley, depend-
35 ing on the rotational speed of the motor and on the operative position assumed by the piston, the latter being operable to interdict or permit the radial expansion of the flyweights to varying degrees so as to cause the drum to be rotated at variable transmission ratios.

1 This solution thus lacks the above described tensioning
roller, resulting in the elimination of the vibrations
and noises set up by such a roller in the entire washing
machine.

5 In addition, as the transmission belt is always kept under
tension by the hinged arm, the distance between the driv-
ing and driven pulleys of the washing machine does not
require any manual adjustment.

10 These and other objects are obtained according to the in-
vention by a speed variator for a laundry washing machine
comprising a laundering tub, a drum mounted for rotation
within the tub, and a motor for rotating said drum at the
laundrying and centrifuging speeds, said speed variator
15 including at least one transmission belt interconnecting a
driving pulley of said motor and a driven pulley associated
with said drum, and a number of flyweights associated with
at least one of said pulleys, preferably the driving pulley,
the effective diameter of which is variable, said fly-
20 weights being adapted to expand radially at the centrifug-
ing speed of said motor so as to correspondingly vary the
effective diameter of the associated pulley, said speed
variator further including at least one hydraulic piston
or the like mounted for reciprocating displacement in a
25 corresponding cylinder connected to the water supply circ-
uit of the machine via a three-way valve and at least one
solenoid valve or the like operable to control the supply
and discharge of a liquid to, or from, respectively, said
cylinder for displacement of said piston to different oper-
30 ating positions.

According to the invention, this speed variator is charact-
erized in that said motor, together with said variable-
diameter pulley, is carried by a hinged arm having one of
35 its ends hinged to a lower portion of said tub while hav-
ing its other end connected to said piston, Said arm being
biased by resilient means in a direction causing said
variable-diameter pulley to continually tension said belt,

1 irrespective of the radial expansion of said flyweights,
said piston being adapted to act on said hinged arm so as
to interdict or to permit to a variable degree the radial
expansion of said flyweights depending on the respective
5 operating position assumed by the piston.

The characteristics and advantages of the invention will
become more clearly evident from the following description
given by way of example with reference to the accomp-
10 anying drawings, wherein:

fig. 1 shows a partially sectioned rear view of a laundry
washing machine provided with a speed variator accord-
ing to the invention, the latter being in a first
operating position,
15

fig. 2 shows a top plan view of the speed variator accord-
ing to fig. 1 as sectioned along the line I-I in
fig. 1, and

20 fig. 3 shows a view similar to that shown in fig. 1, with
the speed variator in a second operating position.

With reference to figs. 1 and 2, there is diagrammatically
shown a laundry washing machine 4 having a laundering tub 5
and a rotatable drum 6 mounted within tub 5 and adapted to
25 be rotated by an electric motor 7 via at least one trans-
mission V-belt 8 interconnecting a driving pulley 9 of
motor 7 and a driven pulley 10 associated with tub 6.

In particular, driving pulley 9 is of the variable-diameter
30 type essentially composed of a disk 11 fixedly secured to
a shaft 12 of motor 7, and a further disk 13 mounted on
shaft 12 for displacement towards and away from fixed disk
11 and operatively connected to a number of radially ex-
pandable flyweights 14.

35 Energization of motor 7 thus causes driving pulley 9 to be
rotated together with flyweights 14. Merely by way of
example, motor 7 may be designed to rotate drum 6 at differ-
ent speeds, namely, a reduced laundering speed of for inst-

1 ance about 50 rpm, and an increased centrifuging speed of
2 about 800 rpm. A satisfactory result may also be obtained
3 when only driven pulley 10 or both pulleys 9 and 10 are of
4 the variable-diameter type, these modifications being also
5 included within the scope of the invention.

6 Flyweights 14 are dimensioned so as to expand to the full
7 radial extent at the maximum rotational speed of motor 7.
8 This radial expansion of flyweights 14 causes movable disk
9 13 to be displaced towards fixed disk 11 so as to vary the
10 effective diameter of pulley 9. In this manner, transmiss-
11 ion belt 8 is shifted to different effective diameters of
12 driving pulley 9 for rotating drum 6 at variable transmiss-
13 ion ratios.

14 In particular, the belt may be shifted in this manner from
15 the laundering speed position shown in fig. 1 to the centri-
16 fuging speed position shown in fig. 3.

17 The laundering tub 5 of the present invention has its
18 lower portion provided with brackets 15 and 16 for con-
19 nection to conventional vibration dampeners (not shown)
20 and with two identical mounting arms 17, 18 of reduced
21 thickness secured to the bottom portion of tub 5 parallel
22 to one another.

23 Also provided is a rigid arm 19 of an arcuate profile
24 corresponding to the circumferential shape of motor 7, the
25 width of arm 19 being somewhat smaller than the axial length
26 of motor.

27 As particularly shown in fig. 2, arm 19 serves for carry-
28 ing motor 7 together with driving pulley 9, to which purpose
29 motor 7 is provided with lugs 21 welded to its upper port-
30 ion and secured to arm 19 by means of bolts and nuts 20 or
31 similar fastener elements. The arm may also be integrally
32 connected to motor 7. In the embodiment shown, arm 19 is
33 formed with parallel upstanding sidewalls 22 and 23 having
34 one end thereof hingedly mounted between support arms 17
35 and 18 by means of a transversely extending bolt 24 threaded

- 1 into corresponding bores formed in the support arms and
sidewalls and fixed to the support arms in a per se known
manner.
- 5 Adjacent bolt 24 there is provided at least one torsion
spring 25 having its free ends 26 and 27 anchored respect-
ively to one of the support arms, for instance support arm
18, and one of the upstanding sidewalls, for instance
sidewall 23 of carrier arm 19.
- 10 Torsion spring 25 is provided for permanently biasing
carrier arm 19, and thus motor 7 together with driving
pulley 9, in the direction indicated by arrow A in fig.1,
so that transmission belt 8 is always kept under tension
irrespective of its being shifted to different effective
15 diameters corresponding to the respective positions assumed
by flyweights 14. As a result, there is no need for manual
adjustment of the spacing between driving and driven pulleys
9 and 10, respectively, as in prior art machines.
- 20 For ensuring proper movement of carrier arm 19 over a lim-
ited range and without lateral displacement, the sidewalls
of carrier arm 19 and the adjacent mounting arms are oper-
atively interconnected by a slot and pin system 28.
- 25 In addition to the components describd, the speed variator
according to the invention includes at least one hydraulic
or oleo-dynamic piston 29 mounted for reciprocating dis-
placement in an associated cylinder 30 secured to bracket
16 of tub 5 and connected through a solenoid valve 31 and
a pipe 32 to a three-way connector 33 provided in the
30 water supply circuit 34 of the machine, supply circuit 34
itself being connected to a detergent distributor 35 and
to the external water supply mains through a further
solenoid valve 36.
- 35 The same result may be obtained by connecting cylinder 30
to a separate pressurized container (not shown) accommod-
ated within the housing of the machine.

- 1 Three-way connector 33 may advantageously be provided with
a conventional filtering element (not shown) for ensuring
proper operation of piston 29 by once again filtering the
water derived from the supply circuit of the machine.
- 5
Piston 29 is operatively connected to the free end of
carrier arm 19 by a rod 37 for adjustment to different
operating positions by sliding displacement in cylinder 30
in the same manner as described in Italian Patent Applic-
10 ation No. 45737-A/83 filed on 12-23-83 by the present
applicant, according to which patent application the piston
is connected to a tensioning roller for biasing it into
pressure engagement with the transmission belt of the
machine.
- 15
The purpose of piston 29 is to interdict or permit the
radial expansion of flyweights 14 to varying degrees
determined by the operating position of the piston for
permitting belt 8 to be shifted to correspondingly varying
effective diameters of driving pulley 9 so as to rotate
20 drum 6 at different transmission ratios.

The speed variator according to the invention operates as follows:

At the beginning of a laundering cycle solenoid valves 36
25 and 31 are energized for supplying mains water to tub 5
via distributor 35 and supply circuit 34 and to cylinder
30 via pipe 32 (cf. fig. 1).

When cylinder 30 is completely filled with water, solenoid
30 valve 31 is closed so as to prevent the water from escap-
ing from cylinder 30.

The pressure of the water in cylinder 30 is effective to
displace piston 29 to its fully extended position so as to
cooperate with torsion spring 25 in rotating carrier arm
35 19 in the direction of arrow A to a position determined by
the tension of belt 8. Carrier arm 19 is then stably re-
tained in this position irrespective of the rotational
speed of motor 7, because the force exerted by piston 29

1 on carrier arm 19 overcomes the oppositely directed force
acting thereon as a result of the tendency of flyweights
14 to radially expand. Consequently the effective diameter
of pulley 9 remains unchanged even at the maximum rotat-
5 ional speed of motor 7. During the initial phase of the
washing cycle, however, motor 7 rotates only at the laund-
ering speed, at which the flyweights 14 are not radially
expanded, so that driving pulley 9 is maintained at its
minimum effective diameter.

10 During a subsequent phase, motor 7 is switched to its
centrifuging speed, at which flyweights 14 tend to expand
radially, such radial expansion being still prevented from
occurring, however, by the action of piston 29 on carrier
15 arm 19 precluding its rotation about bolt 24.

As a result, drum 6 is now rotated at a higher speed than
previously, without however being able to attain the
maximum centrifuging speed.

20 In the example described, the drum is now rotated at a
speed of about 400 rpm prior to carrying out the centri-
fuging step at the maximum rotational speed.

For attaining this maximum speed, motor 7 is kept switched
25 to high speed operation, and solenoid valve 31 is energ-
ized for permitting the water contained in cyclinder 30 to
be discharged therefrom into tub 5 via pipes 32 and 34 and
detergent distributor 35.

30 As a result, carrier arm 19 is no longer retained by pist-
on 29 in its previous position, and is now rotated in the
direction indicated by arrow B by the force resulting from
the radial expansion of flyweights 14 in opposition to the
bias of spring 25, this rotation of carrier arm 19 being
limited by the slot and pin system 28 (cf. fig. 3).

35 In this operating condition, carrier arm 19 has pushed
piston 29 completely back into cylinder 30, while driving
pulley 9 assumes its maximum effective diameter for rotat-
ing drum 6 at the maximum centrifuging speed.

1 In a similar manner it is also possible to rotate the drum
at intermediate speeds between the laundering and centri-
fuging speeds by permitting the water previously supplied
to cylinder 30 to be gradually discharged therefrom into
5 the tub for displacing piston 29 to different operating
positions. This may be done by energizing solenoid valve
31 repeatedly and at predetermined intervals.

The present speed variator is of simple construction and
10 reduced dimensions, permitting it to be readily installed
in a restricted space within the housing of a laundry
washing machine.

The speed variator also permits the drum to be reliably
rotated at different rotational speeds between the launder-
15 ing and centrifuging speeds while eliminating the gener-
ation of vibration and noise caused in prior art machines
by the employ of tensioning rollers acting on the trans-
mission belt.

20 The speed variator finally ensures proper tensioning of the
transmission belt 8 at all times, irrespective of the rot-
ational speed of motor 7 and thanks to the spring-biased
mounting of carrier arm 19, without the need for manual
adjustments.

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GRÜNECKER, KINKELDEY, STOCKMAIR & PARTNER

PATENTANWÄLTE
EUROPEAN PATENT ATTORNEYS

1

A. GRÜNECKER, DIPL. ING.
DR. H. KINKELDEY, DIPL. ING.
DR. W. STOCKMAIR, DIPL. ING. AEE (CALTECH)
DR. K. SCHUMANN, DIPL. PHYS.
P. H. JAKOB, DIPL. ING.
DR. G. BEZOLD, DIPL. CHEM.
W. MEISTER, DIPL. ING.
H. HILGERS, DIPL. ING.
DR. H. MEYER-PLATH, DIPL. ING.
DR. M. BOTT-BODENHAUSEN, DIPL. PHYS.
DR. U. KINKELDEY, DIPL. BIOL.

5

*LICENCIÉ EN DROIT DE L'UNIV. DE GENÈVE

8000 MUNICHEN 22
MAXIMILIANSTRASSE 58

10 Zanussi Elettrodomestici S.p.A
Via Giardini Cattaneo, 3
33170 Pordenone-C.P. 147
I t a l i e n

EP 2482

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20 Speed Variator for Laundry Washing Machines

C l a i m s

1. A speed variator for a laundry washing machine having
25 a laundering tub, a drum mounted for rotation within said
tub, and a motor for rotating said drum at laundering and
centrifuging speeds, said speed variator including at
least one transmission belt interconnecting a driving
pulley and a driven pulley of said motor and said drum,
30 respectively, and a number of flyweights associated with
at least one of said pulleys, preferably the driven pulley,
said pulley being of the variable-diameter type, said
flyweights being adapted to expand radially at the centri-
fuging speed of said motor so as to correspondingly vary
35 the effective diameter of the associated pulley, said
speed variator further including at least one hydraulic
piston or the like mounted for reciprocating displacement
in an associated cylinder connected to the water supply

1 circuit of the machine through a three-way connector and
at least one solenoid valve or the like adapted to control
the supply and the discharge of a liquid to, and from,
respectively, said cylinder so as to displace said piston
5 to different operating positions, characterized in that
said motor (7) together with said variable-diameter pulley
(9) is supported by at least one rotatable carrier arm
(19) having one of its ends hinged to a lower part of said
tub (5) while its other end is connected to said piston
10 (29), said carrier arm (19) being biased by resilient
means (25) towards a position whereat said variable-dia-
meter pulley (9) constantly maintains said belt (8) in a
tensioned state against the action of the radial expansion
of said flyweights (14), said piston (29) being adapted to
15 act on said carrier arm (19) in a manner to interdict or
permit the radial expansion of said flyweights (14) to
varying degrees depending on the operating positioon
assumed by said piston (29).

20 2. A speed variator according to claim 1, characterized
in that said rotatable carrier arm (19) is of an arcuate
configuration having the same profile and a slightly
smaller width than said motor (7) for permitting said
carrier arm (19) to be fitted and secured to the top
25 portion of said motor.

3. A speed variator according to claim 1, characterized
in that said rotatable carrier arm (19) is integrally
connected to said motor (7).

30 4. A speed variator according to any of claims 1 to 3,
characterized in that said rotatable carrier arm (19) is
formed with upstanding sidewalls (22, 23) extending
parallel to one another and adapted to be connected to
rigid mounting arms (17, 18) secured in proximity thereto
35 to the lower portion of said tub (5) by means of respective
slot and pin systems (28).

1 5. A speed variator according to claim 4, characterized
in that said resilient means comprise at least one torsion
spring (25) or the like disposed adjacent an articulat-
ing bolt (24) of said carrier arm (19) and having its ends
5 (26, 27) anchored to one (18) of said mounting arms and
the adjacent sidewall (23) of said carrier arm, respect-
ively.

6. A speed variator according to any of claims 1 to 5,
10 characterized in that said three-way connector (33) may
be provided with at least one filter element of convent-
ional type.

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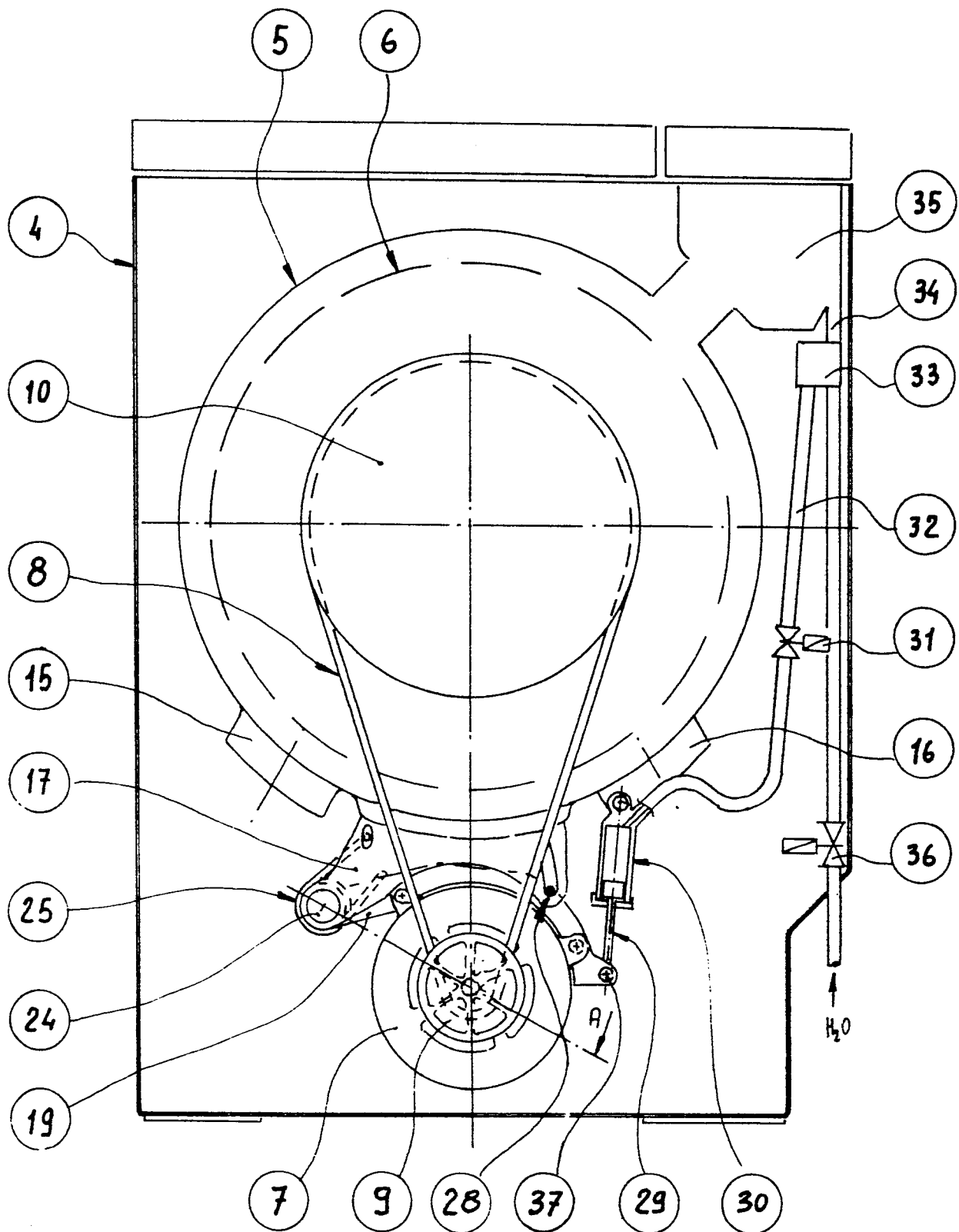


fig. 1

fig. 3

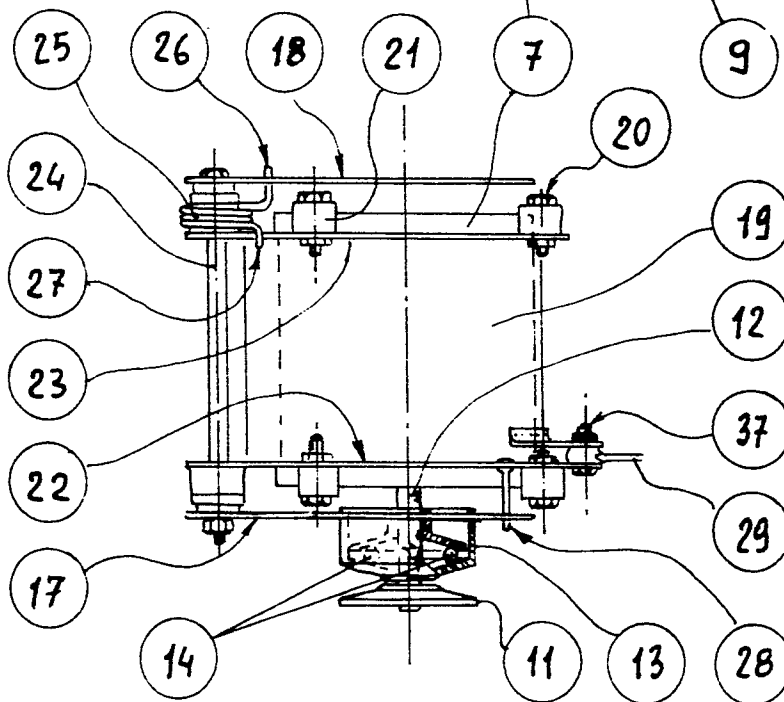
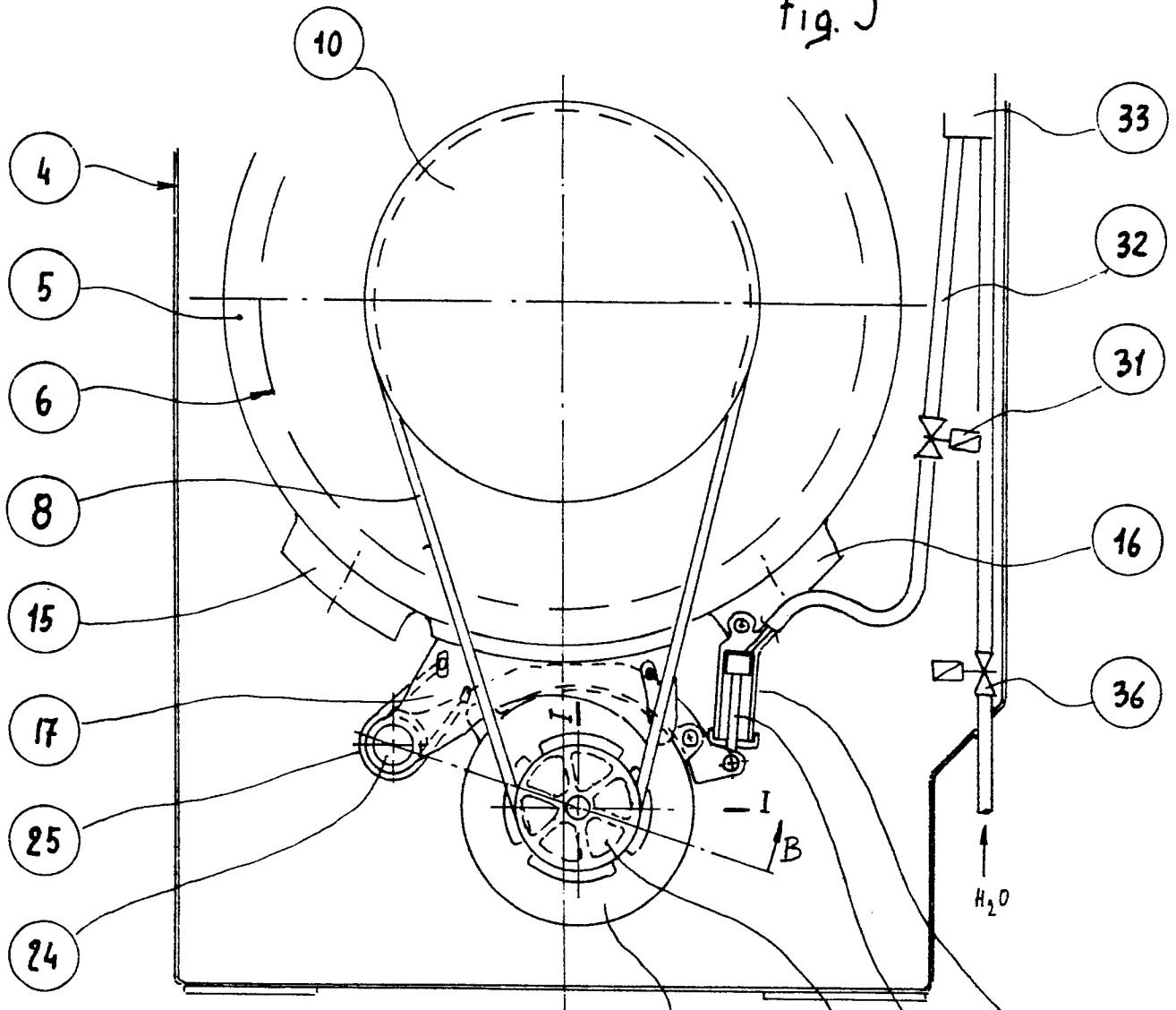


fig. 2