(12) UK Patent Application (19) GB (11) 2 243 899 (13) A

(43) Date of A publication 13.11.1991

(21) Application No 9108803.9

(22) Date of filing 24.04.1991

(30) Priority data
(31) 9005272 (32) 25.04.1990 (33) FR

(51) INT CL⁵
F16F 15/12

(52) UK CL (Edition K)
F2U U234 U286 U340 U398
U1S S1990

(56) Documents cited
GB 2171494 A GB 1001538 A WO 89/01097 A
US 4729464 A

(58) Field of search
UK CL (Edition K) F2U
INT CL⁵ F16F 15/12

(71) Applicant
Valeo

(Incorporated in France)

43 Rue Bayen, 75848 Paris, Cedex 17, France

(72) Inventors
Jacky Naudin
Jacques Paquin

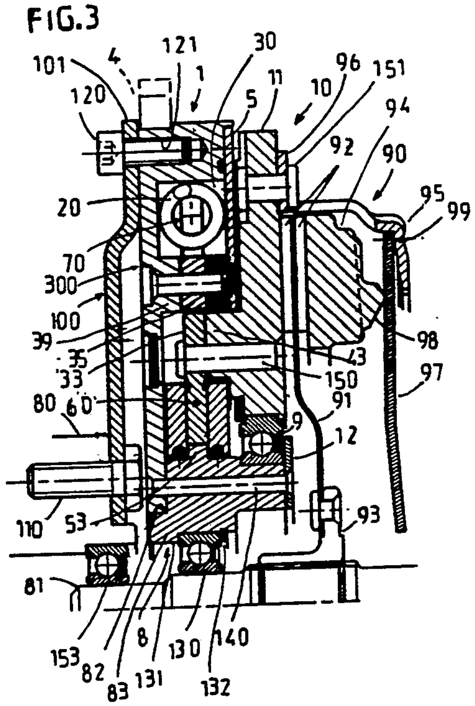
(74) Agent and/or Address for Service
Page White & Farrer
54 Doughty Street, London, WC1N 2LS,
United Kingdom

(54) **A torsion damped double flywheel for an internal combustion engine**

(57) A torsion damped double flywheel for an internal combustion engine in a motor vehicle comprises a first inertia mass (1) which includes a hub (8), and a second inertia mass (10) which is mounted on the hub (8) by means of a first bearing means (9). The second inertia mass includes a secondary flywheel (11) carrying a friction clutch (90), and at least one torsion damper (70) which couples the first and second inertia masses (1, 10) together.

The first inertia mass (1) includes a support (100) which is secured to the engine output shaft (80) by first fastening means (110), together with a primary member (300) which is arranged to be fastened to the support (100) by second fastening means (120). The primary member (300) is secured to the hub (8) of the first inertia mass (1), and is also coupled to the torsion damper (70), so as to form a preassembled, unitary assembly with the first inertia mass (10), the torsion damper (70) and the friction clutch (90).

FIG.3



GB 2 243 899 A

FIG.1

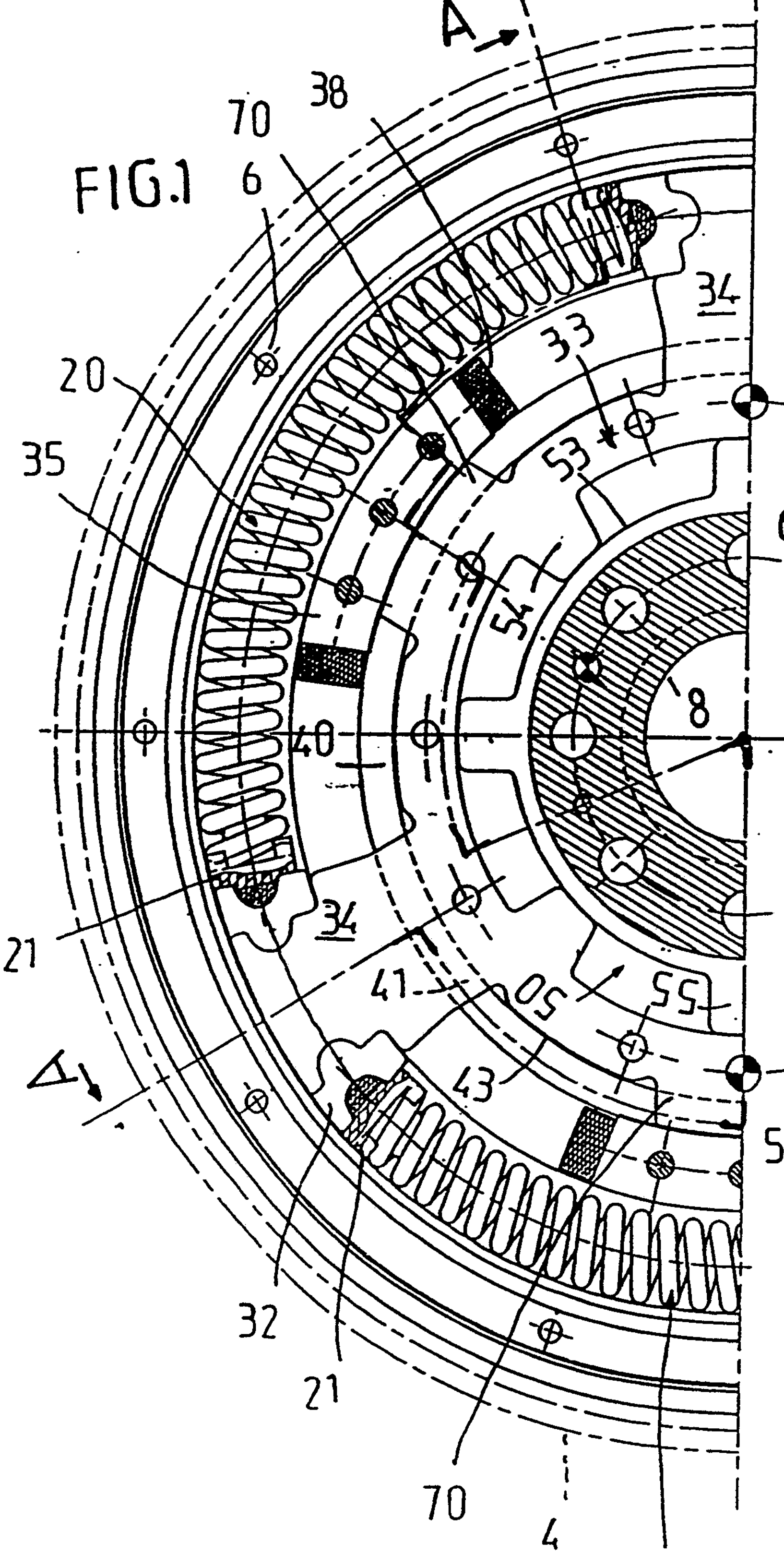

A
70
38
6
34
33
39
20
53
35
54
8
40
21
34
41
50
55
43
32
21
70
4
20
A

FIG.2

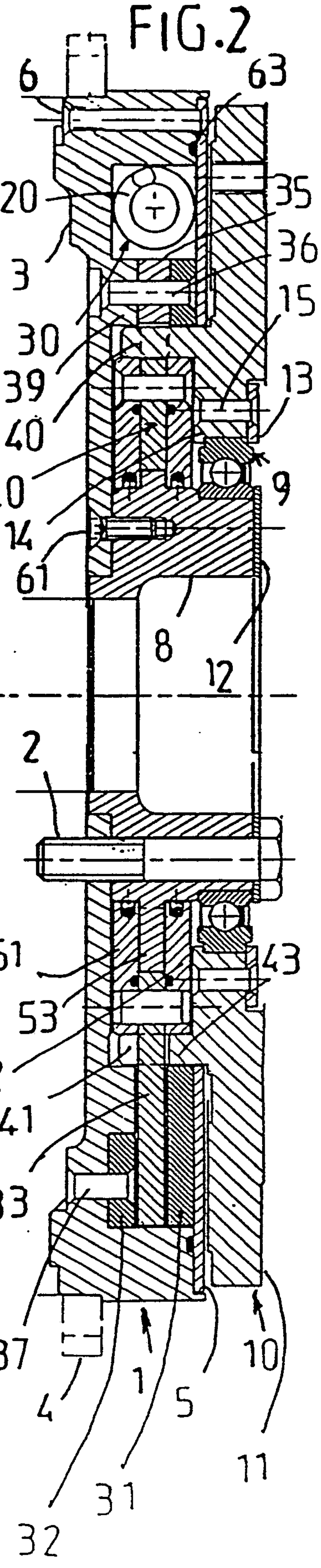

6
63
20
35
3
36
15
30
39
13
40
60
9
14
61
8
12
2
51
43
53
52
41
33
37
1
4
5
10
32
31
11

FIG.3

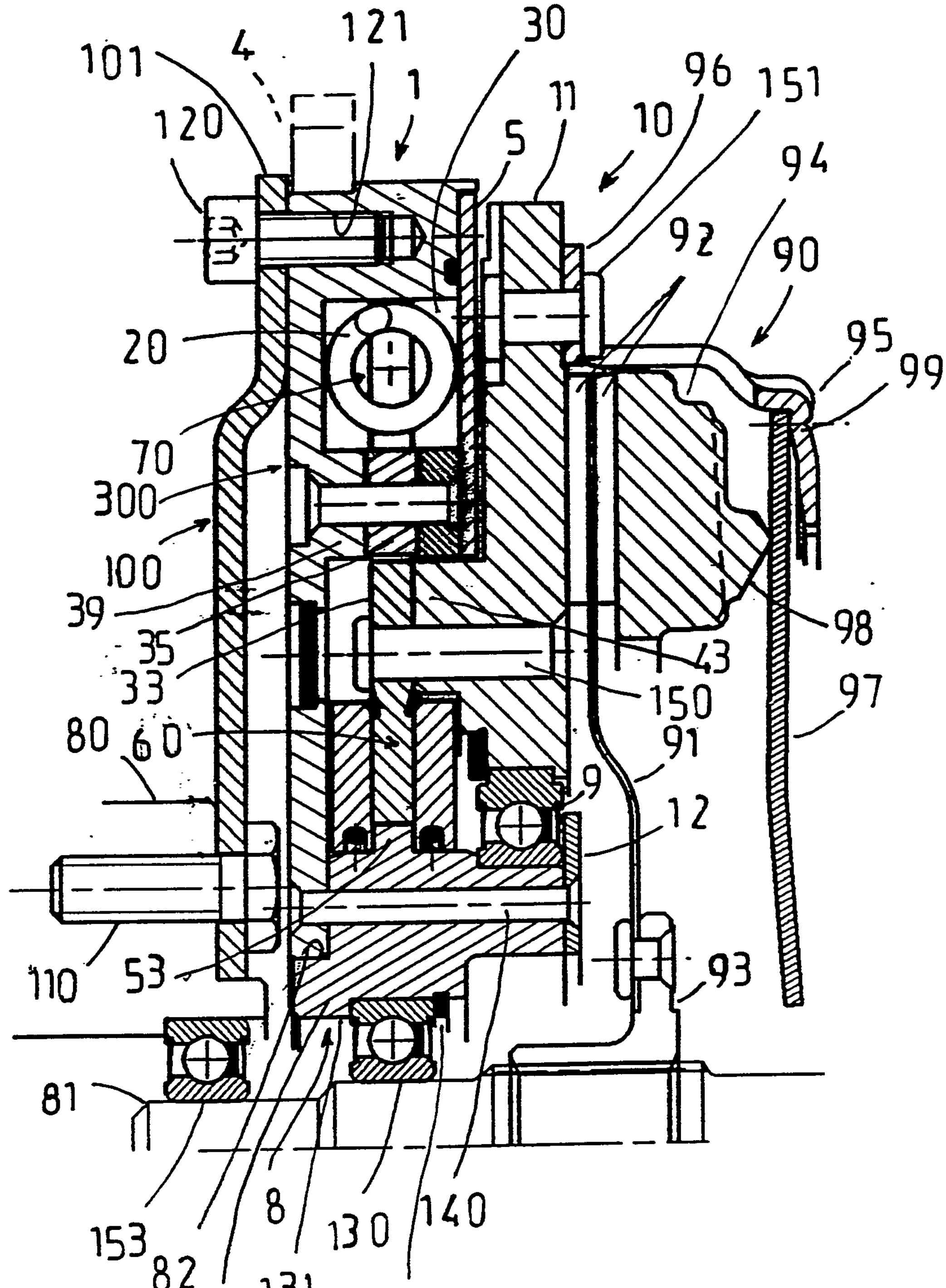

101
4
121
30
1
120
96
151
11
10
5
94
92
90
20
95
99
70
300
100
98
39
35
43
33
150
97
80
60
91
9
12
110
53
93
81
153
82
83
8
131
130
140
132

FIG. 4

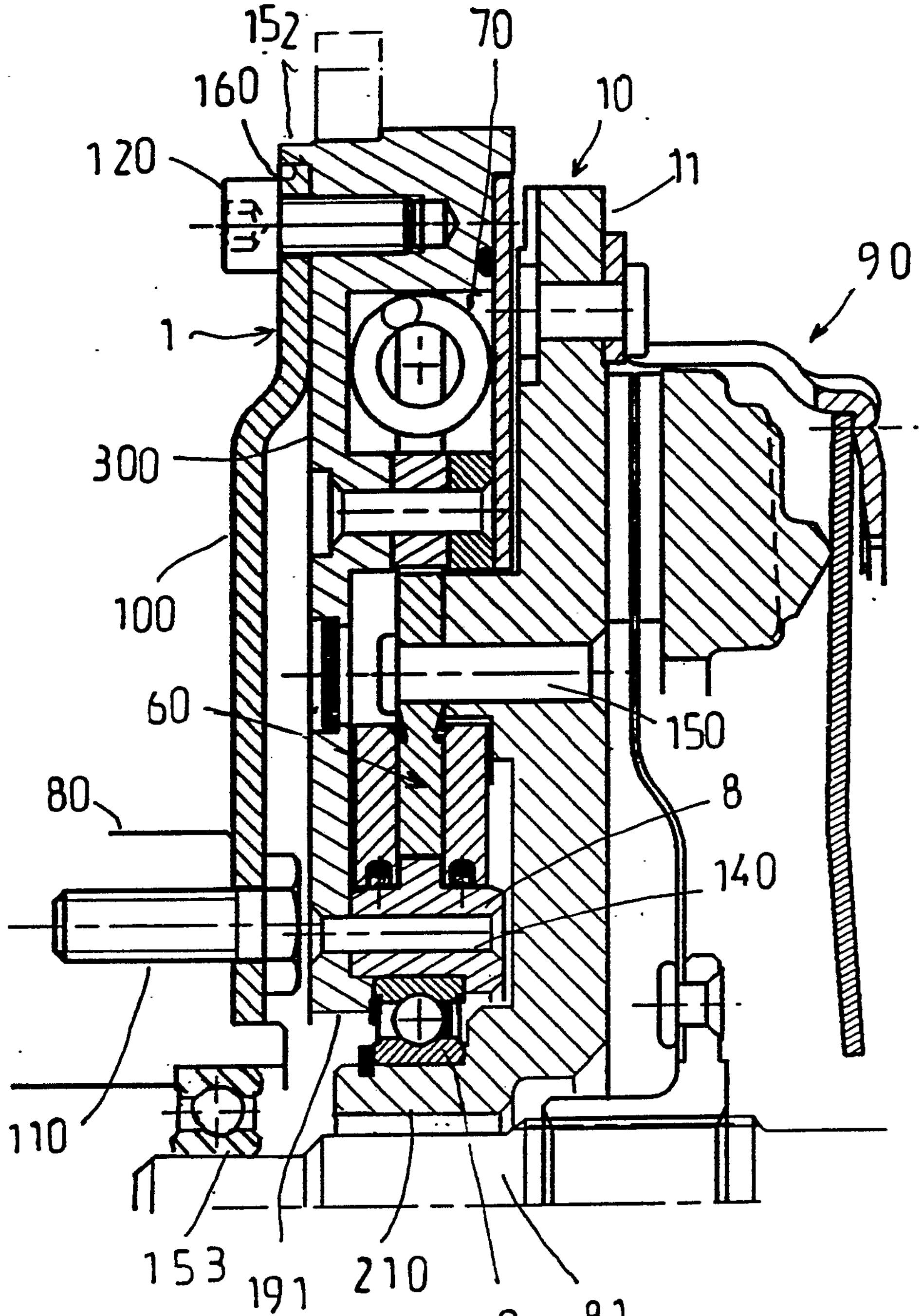
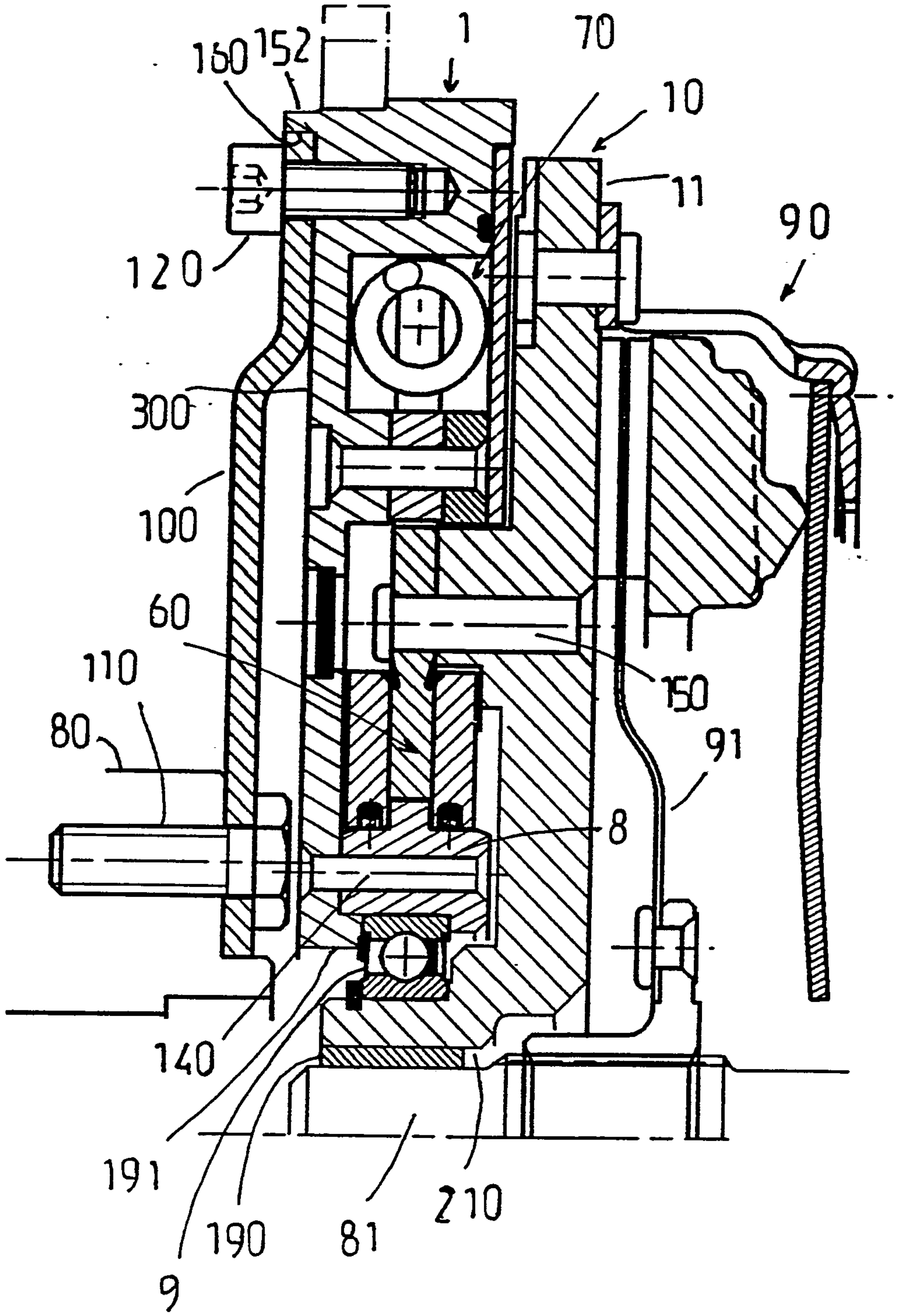

152
70
160
10
120
11
90
1
300
100
60
150
8
80
140
110
153
191
210
9
81

FIG.5


160
152
1
70
10
11
90
120
300
100
60
150
110
80
91
8
140
191
190
81
210
9

A TORSION DAMPED DOUBLE FLYWHEEL FOR AN INTERNAL COMBUSTION ENGINE

The present invention is concerned with a torsion damped double flywheel for an internal combustion engine, of the kind comprising: a first inertia mass, adapted to be secured to the output shaft of the engine and including a hub; a second inertia mass, which is mounted on the hub of the first inertia mass through a first bearing means, the second inertia mass including a secondary flywheel carrying a friction clutch, which has at least one friction disc adapted to be coupled to the input shaft of the gearbox for rotation with it; and at least one torsion damper coupling the first inertia mass to the second inertia mass. A double flywheel of this kind will be referred to as a "double flywheel of the kind specified".

A double flywheel of this kind is described in the specification of French patent application No. 90 03821 filed on 26 March 1990. As described in that specification, the hub 8 is secured to the crankshaft of the engine (see Figures 1 and 2 of the French specification), and it is difficult to test the double flywheel before it is finally fitted.

A double flywheel of the kind specified is also described in the specification of French published patent application FR 2 577 643A, in which the torsion damper constitutes, with a torque limiter, a common assembly of enclosed and preassembled construction. Such an arrangement enables the various components of the double flywheel to be tested for correct operation before the torsion damped double flywheel is finally fitted. To that end, specific fastening means are provided which are separate from the fastening screws which secure the hub to the engine crankshaft.

The presence of such fastening screws makes the assembly of a module, comprising the friction clutch and the secondary flywheel, difficult to carry out before the final fitting of the double flywheel. In this regard, the secondary flywheel carries a friction clutch, and the latter tends to hinder the placement and tightening of the fastening screws, particularly because of the presence of the friction disc of the clutch.

In order to overcome these drawbacks, it is possible to resort to a solution of the kind which is exemplified in the arrangement described in the specification of United States patent No. 4 729 464. However, this solution is not satisfactory because it calls for drastic modification of the friction clutch.

An object of the present invention is to overcome these drawbacks, while providing a novel arrangement in which the torsion damped double flywheel can be tested before being finally fitted, with a module being constructed which comprises part of the first inertia mass, the torsion damper, the secondary flywheel and a standard friction clutch.

According to the invention, in a double flywheel of the kind specified, the first inertia mass includes a support which is adapted to be secured to the output shaft of the internal combustion engine by first fastening means, together with a primary member which is adapted to be secured to the said support by second fastening means, the primary member being secured to the hub of the first inertia mass and coupled to the torsion damper, whereby to constitute, with the second inertia mass, the torsion damper and the friction clutch, a preassembled unitary assembly.

The invention enables the double flywheel, in the form of a module, to be tested before being finally fitted, while still enabling it to incorporate a conventional friction clutch. It will also be appreciated that the invention enables a damped double flywheel per se to be constructed and to be then fitted on to the said support of the first inertia mass.

According to a preferred feature of the invention, the said hub carries a second bearing means for mounting it on the input shaft of the gearbox. This enables the said support of the first inertia mass to be mounted on the crankshaft by means of the first fastening means. It also enables a module to be mounted on the input shaft of the gearbox, through the second bearing means, this module comprising the friction clutch, the secondary flywheel, the torsion damper, the hub and the primary member; subsequently, after the gearbox and the engine have been brought together, the module can then be finally fitted by assembling the support and the primary member together and securing them with the second fastening means.

The hub and the primary member are thus supported and centred by the input shaft of the gearbox. In a variant, the primary member may be centred by the said support, and to this end it preferably carries centring means. In that case it is possible, before final fitting, to fit the whole of the torsion damped double flywheel, equipped with its friction clutch, on to the engine crankshaft, and then to insert the input shaft of the gearbox while the latter is being offered up to the engine.

It will be appreciated that the friction clutch may be of a conventional type, and that the torsion damper can include lubricated, circumferentially acting, resilient means mounted in a first cavity, with a viscous damping means also being able to be provided if required, in the manner disclosed in the French patent application No. 90 03821 mentioned above.

The present invention thus enables the advantages of a high displacement double flywheel to be preserved, and also enables a conventional friction clutch to be used.

Various embodiments of the invention will now be described, by way of example only and with reference to the accompanying drawings, in which:-

Figure 1 is a partial front view showing one half of the double flywheel as disclosed in French patent application No. 90 03821;

Figure 2 is a view in axial cross section taken on the broken line A-A in Figure 1;

Figure 3 is a view in axial cross section, similar to Figure 2 but showing one half of a damped double flywheel in accordance with the invention;

Figures 4 and 5 are views similar to Figure 3, but show further embodiments.

The torsion damped double flywheel, for motor vehicles with internal combustion engines, which is shown in the drawings comprises two coaxial inertia masses 1 and 10, mounted for relative rotation with respect to each other against the action of resilient means 20 which form part of a torsion damper 70. This relative rotation also acts against the action of a viscous damper 60.

For simplicity, the same reference numerals will be used for those elements which are common to French patent application No. 90 03821 (to which reference will be made in this description) and to the those of the apparatus described with reference to Figures 3 to 5.

The double flywheel includes a first inertia mass 1 which is arranged to be secured to the output shaft 80 of the engine of the vehicle, and which includes a hub 8, hollow in the middle and through which the input shaft 81 of the gearbox extends. A second inertia mass 10 is mounted on the hub 8 through a first bearing means 9, and includes a secondary flywheel 11 carrying a friction clutch 90. The latter has at least one friction disc 91 which is arranged to be coupled in rotation to the input shaft 81. The first and second inertia masses 1 and 10 are coupled together through the torsion damper 70.

The first inertia mass 1 includes a support 100 and a primary member 300. The support 100 is adapted to be fastened to the output shaft 80 of the engine by means of first fastening means 110. The fastening means 110 and the member 300 are secured to the support 100 by means of second fastening means 120. The primary member 300 is secured to the hub 8 of the first inertia mass 1, and is also coupled to the torsion damper 70, so that it, together with the second inertia mass 10, the torsion damper 70 and the friction clutch 90 together constitute a preassembled unit.

In Figure 3, the hub 8 carries a second bearing means 130 through which it is mounted on the gearbox input shaft 81. The support 100 comprises a simple sheet steel plate, while the first fastening means 110 and the second fastening means 120 both consist of screws. The screws 120 are arranged at the outer periphery of the support plate 100, while the screws 100 are arranged at the inner periphery of the same plate. Also at its outer periphery, the support plate 100 has a portion 101 which is offset axially from its main, central, portion. The support plate is centred at its inner periphery by means of a nose formed on the output shaft 80. In this example the latter is the crankshaft of the engine of the vehicle. Because of the offset portion 101, through which the fastening screws 120 extend, and which is offset axially away from the shaft 80, the screws 110 form no obstacle for the primary member 300. The offset of the portion 101 is chosen to enable sufficient space to be provided to accommodate the heads of the screws 110.

The primary member 300 is in the form of a housing, and is similar to the housing 3 in Figures 1 and 2. The member 300 carries a starter crown 4 and is secured through its base to the hub 8, in this example by means of rivets 140. The axially orientated peripheral flange of the housing member 300 carries the starter crown 4, and has blind threaded holes 121 formed in it to accommodate the screws 120. After the screws 120 have been fitted, the offset portion 101 of the plate 100 engages against the housing member 300. In this example the latter constitutes a primary flywheel and is closed by a cover member 5. The cover member 5 is secured (by means of rivets denoted by the reference numeral 6 in Figure 2) to the hollow primary housing member 300, the latter being annular in shape, as is the cover member 5. The housing member 300 also constitutes the input element of the torsion damper 70.

Secured to the housing member 300 are guide rings in the form of a plurality of blocks facing each other in pairs (see Figure 2 at 31 and 32). Some of these blocks are secured directly by means of rivets to the base of the housing member 300, while the remaining blocks are secured by means of further rivets to the cover plate 5 that is secured to the housing member 300. The output element of the torsion damper 70 is constituted by a plate 33, which is secured to the secondary flywheel 11 by a plurality of rivets 150. The plate 33 is arranged axially between the two guide rings. It has radial arms (which can be seen in Figure 1 at 34) for engagement on the resilient means 20 of the torsion damper 70, which are interposed operatively between the two inertia masses 1 and 10. The resilient means 20 consist of coil springs which are mounted between two consecutive blocks of the guide rings by means of pivoting inserts as indicated at 21 in Figure 1. These inserts 21 are arranged to come into engagement with the radial arms 34.

The second inertia mass 10 comprises the secondary flywheel 11, which acts as the reaction plate of the friction clutch 90, and with which the friction disc 91 of the clutch is arranged to come into contact, the friction disc 91 being secured in rotation to the input shaft 81 of the gearbox. The friction disc 91 carries at its outer periphery friction pads 92, while at its inner periphery it has a splined hub 93 whereby it is mounted on the input shaft 81, the latter being similarly splined.

The friction disc 91 is gripped through its friction pads 92 axially between the secondary flywheel 11 and a pressure plate 94, which is secured to a cover plate 95 for rotation with the latter, while being mounted for axial movement with respect to the cover plate 95, for example by means of tangential tongues (not shown). In a variant, the axial mobility of the plate 94 can be obtained by means of a tenon and mortice type mounting.

The cover plate 95 surrounds the pressure plate 94, and has at its outer periphery a radial flange 96 for fastening to the flywheel 11, in this example by means of a plurality of rivets 151. The flywheel 11 is recessed to accommodate the corresponding heads of the rivets 151. The cover plate 95 is in the form of a hollow dish and includes a base portion having an engagement surface 99, which in this example is in the form of a bead, and on which a diaphragm 97 engages. This diaphragm also engages on a plurality of projecting noses 98 of the pressure plate 94, so as to urge the latter towards the secondary flywheel 11, so that the friction pads 92 will be gripped between the pressure plate 94 and the reaction plate 11 of the clutch.

In this example, the friction clutch is of the "pull" type, and therefore the outer peripheral portion of the diaphragm 97, which constitutes a Belleville ring, bears internally on the projecting noses 98 and externally on the bead 99. To disengage the clutch, a traction force is simply exerted on the inner end of the diaphragm 97, which is formed as a plurality of radial fingers. This disengages the clutch, which is normally in the engaged condition.

The first bearing means 9 are interposed radially between the flywheel 11 and the hub 8, and may consist of an anti-friction or rolling bearing. In Figure 3, it consists of a rolling bearing 9 which is located axially on the hub 8 by a shoulder formed externally on the latter, and by a retaining ring 12 which is in contact with the outer free end of the hub 8. The rivets 140 pass through the retaining ring 12 and through the hub 8, so as to assemble both the ring 12 and the hub 8 to the housing member 300.

The primary or housing member 300 is mounted around the hub 8, which centres the member 300 by engagement with the inner periphery of the latter, and to this end the hub 8 has a centring surface 82 formed on an axial projection 83 extending towards the support 100. The bearing 9 is located in the flywheel 11 by a shoulder formed in the flywheel and by a retaining ring 13 (see Figure 2). The retaining ring 13 is secured to the flywheel 11 by means of rivets, similar to the rivets 15 in Figure 2 but not shown in Figure 3.

The springs 20 are disposed in a first cavity 30, which is filled with a first lubricating fluid for lubricating the springs 20, for example a suitable grease. The cavity 30 is delimited mainly by the primary member 300, the cover member 5, a wall 39 and a spacer 35. The wall 39 is annular and is orientated axially, being part of the housing member 300, while the spacers 35 carry at each end an elastomeric pad 38 (see Figure 1) and are secured by riveting to the wall 39 of the member 300. The cavity 30 is also delimited by the plate 33, the radial arms of which extend into the cavity 30 itself as can be seen from Figure 1.

The viscous damping means 60 of the double flywheel is mechanically interposed between the two inertia masses 1 and 10. The damping means 60 includes a second, sealed, cavity which can be seen at 50 in Figure 1, and which is filled with a second fluid, different from the first fluid mentioned above in the cavity 30. The cavity 50 is delimited by the inertia masses 1 and 10 themselves, and is located radially inwardly of the first cavity 30.

The viscous damper 60 is fixed with respect to the torsion damper plate 33, being arranged axially between the base of the housing member 300 and the flywheel 11. It is disposed axially between the rolling bearing 9 and the housing member 300. Its cavity 50 is delimited by two discs or cover members (designated by the reference numerals 51 and 52 in Figure 2), which are arranged on either side of the torsion damper plate 33 so that the latter constitutes a spacer between the discs 51 and 52. As shown in Figure 3, the discs 51 and 52 are welded to the plate 33 by means of continuous weld seams. The cavity 50 is further delimited by the hub 8, which has a projecting flange 53 interposed between the discs 51 and 52. The flange 53 constitutes an internal carrying element carrying radially orientated teeth, which penetrate into the second cavity 50 in a direction away from the axis of the assembly.

The torsion damper plate 33 constitutes an external support element and carries, at its inner periphery, a set of teeth which are orientated in the opposite sense from the teeth carried by the flange 53. The teeth of the flange 53 and plate 33 are indicated respectively at 55 and 54 in Figure 1. Between each tooth 55 and the next adjacent tooth 54, calibrated passages are defined between the members 51 and 52. In this example, the second cavity 50 is partially filled with the second fluid mentioned above, this fluid being of high viscosity, for example a silicone grease.

The viscous damper 60 is so designed that it is effective in low speed operation, and in particular on starting and stopping of the engine, when the resonant frequency is passed through below the slow running mode of the engine.

The flywheel 11 has a ring 43, to which the torsion damping ring 33 is secured by means of the rivets 150. The ring 43 cooperates with the cover member 5 to define narrow passages, lying radially between the spacer 35 and the discs 51 and 52 of the viscous damper 60.

The second bearing means 130 is a rolling bearing which is located axially at one side by a shoulder 131 formed on the inner periphery of the hub 8. On the other side, the bearing 130 is located axially by a circlip 132, which is fitted in a groove formed in the hub 8. Another form of bearing may of course be provided instead.

A third bearing means 153 is interposed radially between the crankshaft 80 and the end of the input shaft 81, for supporting the latter. The shaft 81 therefore serves, after fitting of the double flywheel, to centre the hub 8 by means of the bearing 130.

As will be clear from this description and from the drawings, it is possible to mount the support 100 first on the crankshaft 80 by means of the screws 110, and then to fit the other components described above on to the input shaft 81 of the gearbox, by means of the bearing 130. It will be noted that it is possible to test the assembly before it is fitted to the engine.

The transmission train of the vehicle is assembled by offering the gearbox up to the engine and securing the whole by means of the screws 120. It will be appreciated that for this purpose it comprises a module or preassembled unit consisting of the primary member 300, the damper 70, the flywheel 11 and the clutch 90.

In the modified embodiment shown in Figure 4, the primary flywheel 300 may be centred by the support plate 100. For this purpose, the member 300 has a centring surface 160, which is formed on an axially orientated annular projection 152 of the primary member 300. The centring surface 160 cooperates with the outer periphery of the support plate 100. In this embodiment the bearing 130 is omitted, and before completion of the assembly operation, the double flywheel with its dampers, equipped with the clutch 90, can be fitted on to the crankshaft 80; then, as the gearbox is offered up to the engine, the shaft 81 is threaded into the interior of a ring 210 to be described below. The unitary assembly can thus be tested by the manufacturer before the gearbox is fitted.

The ring 210, which is provided in this embodiment as part of the flywheel 11 at the inner periphery of the latter, carries the first bearing means 9 interposed radially between the ring 210 and the inner periphery of the shouldered hub 8. This is by contrast with the embodiment shown in Figure 3, in which the bearing 9 is interposed radially between the outer periphery of the hub 8 and the inner periphery of the flywheel 11. The primary member 300 in this embodiment centres the hub 8 by means of a ring portion 191 of the member 300 at its inner periphery. The ring portion 191 also serves to locate the bearing 9 axially. The bearing 153 supports the free end of the shaft 81 as before.

It will be appreciated that the arrangement shown in Figure 4 reduces the axial bulk of the double flywheel, because the bearing 9 now lies generally in the same radial plane as the torsion damper plate 33.

The present invention is of course not limited to the various embodiments described here. In particular, the various fastening means may consist of rivets or any other suitable fastening means.

It is also possible to combine the various centring means. For example, and referring to Figure 5, in this Figure the primary member 300 is centred by the support plate 100 as in Figure 4, while an anti-friction bearing 190 is interposed between the shaft 81 and the ring 210 of the flywheel 11. It is thus the flywheel 11 that supports the free end of the shaft 81.

Fitting of the assembly shown in Figure 5 is carried out in the same way as in Figure 3, with the anti-friction bearing 190 constituting the second bearing means. Thus, the damped double flywheel itself, with its clutch, is first mounted on to the shaft 81 by means of the bearing 190, and subsequently, after the gearbox and engine have been brought together, the primary member 300 is secured to the support plate 100.

The clutch may be of the "push" type, having a friction disc which may be provided with circumferentially acting resilient means. The clutch may include a plurality of coil springs in combination with declutching levers for operating the clutch. It may also include a plurality of plates 94 (see Figure 3), and a plurality of friction discs 91.

The arrangements of Figures 1 and 2 are of course applicable, with the torsion damper plate 33 being secured to the flywheel 11, for rotation with the latter, by means of a tenon and mortice coupling.

The viscous damper 60 is optional, and the springs 20 may not be lubricated, nor need they include the elastomeric pads 38.

The support plate 100 can include at its outer periphery an axially orientated flange for cooperation with the outer periphery of the primary member 300 and for centring the latter. In that case, it is the support plate 100 which preferably carries the starter crown 4.

Finally, the hub 8 may be integral with the primary member 300, which simplifies problems of relative centring between the said members.

CLAIMS

1. A torsion damped double flywheel for an internal combustion engine, comprising: a first inertia mass, adapted to be secured to the output shaft of the engine and including a hub; a second inertia mass, which is mounted on the hub of the first inertia mass through a first bearing means, the second inertia mass including a secondary flywheel carrying a friction clutch, which has at least one friction disc adapted to be coupled to the input shaft of the gearbox for rotation with it; and at least one torsion damper coupling the first inertia mass to the second inertia mass, wherein the first inertia mass includes a support which is adapted to be secured to the output shaft of the engine by first fastening means, together with a primary member which is adapted to be secured to the said support by second fastening means, the primary member being secured to the hub of the first inertia mass and coupled to the torsion damper, whereby to constitute, with the second inertia mass, the torsion damper and the friction clutch, a preassembled unitary assembly.

2. A double flywheel according to Claim 1, wherein the hub carries a second bearing means for mounting it on the input shaft of the gearbox.

3. A double flywheel according to Claim 1, wherein the support carries centring means for centring the primary member.

4. A double flywheel according to any one of the preceding Claims, wherein the support comprises a plate having an axially offset portion at its outer periphery.

5. A double flywheel according to any one of the preceding Claims, wherein the primary member is in the form of a housing.

6. A torsion damped double flywheel, substantially as described in the foregoing description with reference to the accompanying drawings, being in a form substantially as shown in any one of Figures 3 to 5 of the said drawings.

Published 1991 at The Patent Office, Concept House, Cardiff Road, Newport, Gwent NP9 1RH. Further copies may be obtained from Sales Branch, Unit 6, Nine Mile Point, Cwmfelinfach, Cross Keys, Newport, NP1 7HZ. Printed by Multiplex techniques ltd, St Mary Cray, Kent.