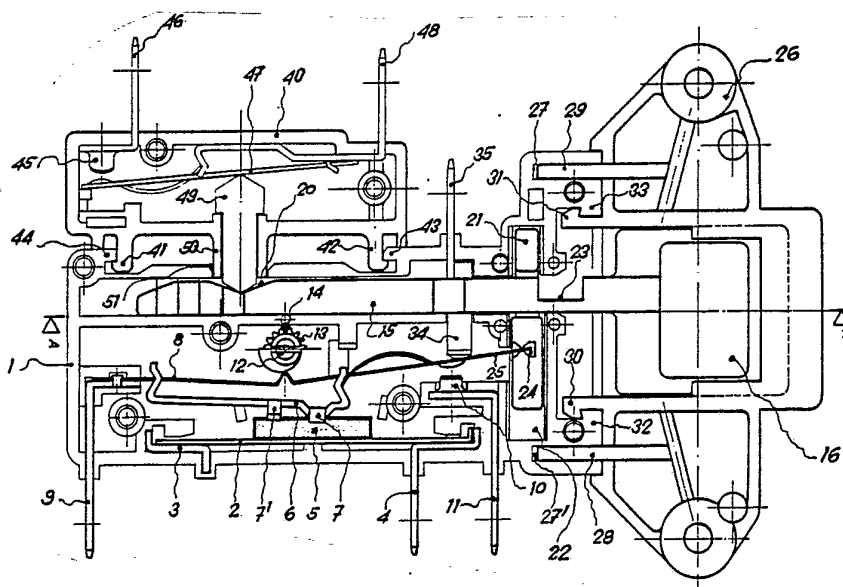




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification⁴ : D06F 37/42</p>	<p>A1</p>	<p>(11) International Publication Number: WO 88/ 05476 (43) International Publication Date: 28 July 1988 (28.07.88)</p>
<p>(21) International Application Number: PCT/EP88/00013 (22) International Filing Date: 6 January 1988 (06.01.88) (31) Priority Application Number: 19177 A/87 (32) Priority Date: 27 January 1987 (27.01.87) (33) Priority Country: IT (71)(72) Applicant and Inventor: ROCCHITELLI, Onofrio [IT/IT]; Via per Lainate, 31, I-20010 Pogliano Milanese (IT). (74) Agent: DE PASQUALE, Carlo; Via Carlo Ravizza, 53, I-20149 Milan (IT). (81) Designated States: AT (European patent), AU, BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), IT (European patent), JP, KR, LU (European patent), NL (European patent), NO,</p>		<p>SE (European patent), US. Published <i>With international search report.</i></p>

(54) Title: DOORLATCH, IN PARTICULAR FOR WASHING MACHINE



(57) Abstract

Doorlatch, in particular for a washing machine, in which a sliding bar (15) working together with the hook (100) and associated with a pin (21) actuated by the mobile contact plate (8) of a microswitch by means of a rocker arm (6) moved by a bi-metallic strip (2) heated by means of a PTC, an appropriate part of the mobile contact plate (8) of the microswitch being, in its turn, subjected to the load of an eccentric ratchet (12), having the function, of correcting the insertion time and the delayed opening of the door-lock. Since the dimensions and configuration of the sliding bar (15) provided with an eyelet (16) and the flange (26) vary according to the type and make of machine, this invention has been designed so that the former can be inserted from outside with the door-locking device already mounted and closed, and the latter can be plugged into the door-lock itself.

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Doorlatch, in particular for washing machine.

5 It is well-known that washing machines must be equipped with devices which can lock the door closing mechanism when the machine is started up and then unlock them with a certain delay after the current has switched off, in order to ensure that the door cannot be opened while some of the components are still rotating inertially (in particular the drum of the spin-dryer).

10 Some types of these devices exist in which the closing and delayed opening is obtained by means of the use of a bi-metal and the time this takes to cool. There are other types of devices, some of them of the same inventor, which carry out the aforesaid functions by other means: magnetic, wax actuated thermostats etc.

15 The object of the present invention is to provide a door-locking device which gives ample guarantees of safety, locking the door before the washing machine is in motion, maintaining this lock during the time the machine is operating up to the time the current is interrupted and beyond this until every rotating part has stopped.

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In addition, the door-locking device according to this invention also functions as a series switch connected to the door in such a way as to ensure that the circuits which actuate the machine cannot close if the door has not been completely shut. This series switch has the added advantage of being in a position which is inaccessible to the user, thus making it impossible to actuate the machine with the door open, even if the user wishes to do this.

A further characteristic of the invention is that the door-locking device is equipped with an extremely simple and effective device which regulates the opening time.

Another characteristic of the invention is the arrangement of its components which makes it possible to construct and mount the body of the device and subsequently add to it the eyelet sliding bar into which the hook of the door-latch and the coupling flange of the washing machine fit. These details vary from manufacturer to manufacturer, therefore the same basic standard device can be used for the most varied types of machines simply by changing these two specific details (sliding bar and coupling flange).

Finally, it has been designed in such a way that the basic body of the door-locking device can, when requested, be connected up to a device which contains the controls of the moving parts of the machine during the washing stage, or to the drying controls if the machine also functions as a dryer, so that the door is not locked during these sequences of the cycle.

The apparatus according to this invention is basically constituted by a sliding bar, working together with the hook of the door closing mechanism, said sliding bar being combined with a pin which locks the aforesaid sliding bar under certain specific conditions, characterised in that the locking pin is actuated by the mobile

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contact plate of a microswitch, having the function of a series switch, by means of a rocker arm moved by a bi-metallic strip, suitably heated, electrically connected to the starting controls of the machine. The appropriate part of the contact plate of the microswitch is, in its turn, subjected to the load of an eccentric ratchet; said load having the function, by increasing or decreasing, of connecting the insertion time and the delayed opening of the door-lock as a function of the possible variations of the time of bending and straightening of the bi-metallic strip during the heating and cooling of the bimetal and the related heating equipment, variations which can occur even between materials of the same lot, since the bi-metallic strip is heated by a P.T.C (Positive Temperature Coefficient). The invention will become clearer if reference is made to the example of an embodiment, an example which is indicative and non-limiting, in the three drawings attached, in which

- Figure 1 represents the device at rest, i.e a cross-section with the door open;
- 15 Figure 2 is a view of A-A in fig 1 of the sliding bar which locks the hook of the door-latch;
- Figure 3 represents the device in the locked position, i.e a cross-section with the door closed;
- 20 Figure 4 is a view of B-B in fig 3 of the sliding bar which locks the hook of the door-latch.

Referring to figures 1, 2, 3 and 4, the device according to the invention is constituted by a boxed body 1 generally moulded in thermoplastic material, acting as a housing for the various components of the device, consisting of:

- 4 - a bi-metallic strip 2 resting on supports 3 and 4 made of electrically
25 conducting materials, support 4 projecting outside the housing in the form of

- 4 -

a connection male contact.

- a P.T.C (Positive Temperature Coefficient) 5, resting with one face on the bi-metallic strip in such a way as also to constitute an electrical contact having, when heated, the function of supplying the heat required for the deformation of the bi-metallic strip;
- a rocker arm 6 made of electrically conducting material, resting on the other face of the P.T.C so as to provide another electrical contact, held in position laterally by supports 7 and 7' and acting on the mobile contact plate of a microswitch by means of its upper arms;
- a microswitch constituted by a mobile contact plate 8 connected to the connection male contact 9 and connected to a connection male contact 11 by means of a fixed contact 10.
- an eccentric cylindrical component 12 with a toothed section 13 which can mesh with the pawl 14;
- a sliding bar 15 terminating outside the box 1 in an eyelet 16 into which the hook of the door-latch 100 is inserted when the door is closed.

A longitudinal cut has been made in the rear half of this sliding bar, opposite the eyelet, (see figures 2 and 4) and, therefore, the bar 15 is divided into two arms which come together and separate elastically because of the characteristics of the material from which they have been made - thermoplastic resin. These arms have two series of lateral notches 17 and 17', 18 and 18' which can engage with the wedges 19 and 19' cut into the body of box 1. This arrangement of the aforesaid part is designed to avoid the use of springs to keep the sliding bar 15 in the correct position, both during opening and when locking.

As can be seen in figures 1 and 3, the upper side of the sliding bar 15 has

- 5 -

another wedge 20 which, as will be explained later, is used for the functioning of the machine controls when the door is unlocked.

The sliding bar 15 can be mounted from outside with the door-latch coupled and is already complete with all its components, so that sliding bar 15 with an eyelet 16 of the appropriate shape and size of the particular make of machine in question can be mounted;

- a locking pin 21 running in a housing 22, the upper part of which locks into a cavity 23 in the sliding bar 15 during the locking stage.

The lower part of the locking pin 21 has an aperture 24 which accepts the prolongation 25 of the mobile contact plate 8 of the microswitch.

- a flange 26 which couples the device to the machine of the appropriate form and size for the particular type and make of machine in question. As has already been said, this component is not moulded in a single piece with the body 1, but constitutes an additional interchangeable component.

To implement this, two slots 27 and 27' have been provided in the body 1, to which can be coupled two arms 28 and 29 protruding from the flange 26 which is also provided with clutch jaws 30 and 31 which couple to two protusions 32 and 33 contained within the box 1.

The device is completed by contact 34 connected to a connection male contact 35 which provides the power for an indicator light which remains lit when the door-lock is not inserted. The door-locking device is electrically connected in series on the phase of the operating current of the machine. Therefore, while one of the supply phases goes directly to the working controls of the machine, the second phase enters through the connection male 9 and passes to the working controls through the connection male contact 11 with the microswitch 8-11 interposed.

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The connection male contact is provided for the connection of the first phase of the electricity supply to the P.T.C 5.

The device functions in the following way. At rest, the various components are in the positions shown in figures 1 and 2 i.e. microswitch 8-11 open; bi-metallic strip 2 in a flat position; sliding bar 15 with eyelet moved forward, in an axis with the hook 100 of the closing latch of the door, this position of the sliding bar 15 (see figure 2) being guaranteed by the locking of the wedges 19, 19' into the notches 17 and 17' of the elastic tail of the bar 15.

When the user closes the door (see figure 4) the hook 100 of the door latch engages with the eyelet 16 and closes, thus pushing the sliding bar 15 backwards from the position shown in figure 2 to the position shown in figure 4 (To be absolutely accurate, figure 4 shows a transition stage of the movement of the sliding bar from the open position to the closed position). The bar 15 stops with the wedges 19 and 19' locked into notches 18 and 18' and with the cavity 23 in axis with the pin 21.

At this point the user starts up the machine and the current flows through the connection male contact 9, the mobile contact plate 8, the rocker arm 6, all the electrically conducting material on one side and, through connection male contact 4, supplies the P.T.C which heats up almost instantaneously and transmits its heat to the bi-metallic strip 2, causing it to arch out and thus raise rocker arm 6. The rocker arm 6 acts on the mobile contact plate 8 of the microswitch, pressing it downwards to close the circuit and thus provide power to the working parts of the machine and, at the same time, lowers the pin 21 so that its upper part can insert itself into the cavity 23 of the sliding bar 15, blocking the bar 15 for as long as these conditions last and, as a consequence, locking the hook 100 of the door latch of the

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machine in the eyelet 16.

When the machine has completed its working cycle and the current is interrupted, the P.T.C cools down, the bi-metallic strip returns to the position in figure 1 and, therefore, the mobile contact plate 8 moves in the opposite direction, reopening the circuit and, at the same time, raising the pin 21 which withdraws from the aperture 23 of the sliding bar 15, freeing it and thus permitting the door to open.

During the opening operation, the hook 100 of the door latch moves from the position shown in figure 3 to the position shown in figure 1, pulling out the locking bolt and moving it from the position shown in figures 1 and 3 to the position shown in figures 2 and 4.

All this does not happen immediately but after a certain lapse of time, approximately 60 seconds. This delay is caused by the time required for the combination of the P.T.C 5 _ bi-metallic strip 2 to cool down, such time being largely predetermined by the characteristics of the bi-metallic strip and the P.T.C but, according to this invention, being capable of adjustment by adjusting the pressure on the mobile contact plate 8 by means of the eccentric ratchet 12 which can be rotated to achieve the delay required, such position remaining constant by means of the hold of the pawl 14 on the teeth 13.

An optional device is now described whose function is to permit the machine to operate even if the door is not locked. This device can be used in machines which have the possibility of opening the door during the washing cycle and, therefore, the door-locking device is energised only during the spin-drying cycle when the drum is rotating very fast and/or in those machines which have a hot-drying cycle.

The device consists of a box 40 with external couplings 41 and 42 which are firmly mounted on the protusions 43 and 44 provided on the outside of the box 1 of

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the door-locking device. The box 40 contains a microswitch constituted by a fixed contact 45 which has an external prolongation with connection male contact 48 and push-button 49 which acts on the mobile contact plate 47.

5 The push-button 49 runs inside a hollow cylindrical housing 50 and, therefore, it can be outside the box 40. In correspondence, the box 1 of the door-locking device has a hole 51 which accepts the aforesaid hollow cylindrical housing 50 so that the push-button 49 can penetrate into box 1 and come into contact with the sliding bar 15 of the door-locking device.

10 As has already been said, the sliding bar 15 has a notch 20. When at rest, with the machine off and the door open, the push-button 49 descends to rest on this and, in this position, the microswitch opens contacts 45-47 as can be seen in figure 1. When the door is closed, as in figure 3, the bar 15, draws back because of the thrust exercised on its eyelet 16 by the hook 100 of the door-latch, (see figure 3) and moves the push-button 49 upwards, closing the circuit. Thus the second phase of the supply current of the working parts of the machine can flow through contacts 46, 45, 15 47, 48 in spite of the fact that the door-locking device is operating, and in this condition the door can be opened during working, and this door opening re-opens contacts 45-47 and stops the working parts.

20 Obviously, this can only happen during the washing and/or drying cycles in which the second phase of the current is supplied by the programme to the working parts of the machine through connection male contacts 46-48 while, during the spin-drying cycle which involves high speed rotation of the drum and inertial rotation, the second phase of the current is fed to the working parts of the machine through the connection male contacts 9-11.

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CLAIMS

1. Device for rapid locking and delayed unlocking of door-closing mechanisms of machines which have internal parts subject to inertial rotation, in particular for doors of washing machines, constituted by a sliding bar (15), working together with the hook (100) of the door latch associated with a pin (24) suitable for locking the aforesaid sliding bar (15) under certain pre-set conditions, characterised by the fact that the locking pin (21) is actuated by the mobile contact plate (8) of a microswitch, having also the function of a series switch, by means of a rocker arm (6) moved by a bi-metallic strip (2) suitably heated, electrically connected to the controls of the machine, the mobile contact plate (8) of the microswitch being in its turn, subjected in the appropriate place to the load of an eccentric ratchet (12), said load being capable of, by increasing or decreasing, adjusting the insertion time and delayed opening of the door lock as a function of the possible variations in the curvature or straightening time of the bi-metallic strip during the heating and cooling stages of the bi-metallic strip and the related heating means, variations which can also occur in materials from the same lot, the heating means of the bi-metallic strip being constituted by a P.T.C (Positive Temperature Coefficient). (5)

2. Device according to claim 1, characterised by the fact that the bi-metallic strip (2) simply rests on supports (3 and 4) and that the P.T.C (5) rests on it, just as the rocker arm (6) rests on the P.T.C, thus ensuring that the curvature and straightening times remain constant through time.

3. Device according to claims 1 and 2, characterised by the fact that to ensure exact positioning of the sliding bar (15) and thus its eyelet (6) during the phases of opening and locked closing, the back part of the sliding bar (15) is divided

into two arms which separate and come together elastically, each of said arms being provided with lateral notches (17 and 17') - (18 and 18') in the appropriate positions to lock into two wedges (19 and 19') provided in correspondence in the box body 1 of the door-locking device.

5 4. Device according to claim 1, characterised by the fact that the flange (26) for coupling the device to the machine - a flange of a different size and configuration according to the type and make of machine on which the device is to be mounted - is not manufactured in a single piece with the body of the door-lock, but is moulded separately and can be connected to the body of the door locking
10 device since the body of the door-locking device is provided with two slots (27 and 28) and two protruberances (32 and 33) which can be coupled respectively to the coupling devices (28 and 29) and two clutch jaws (30 and 31) which are provided on the flange (16).

15 5. Device according to claims 1 and 3, characterised by the fact that the sliding bar (15) with eyelet (16), the latter having the appropriate shape and size for the type and make of machine on which the device is to be mounted, is interchangeable and can be inserted into the finished door-lock quite simply from outside.

20 6. Device according to claim 1, characterised by the fact that the door-locking device can be associated with an optional device which permits the machine to function during certain sequences of the working cycle - washing or drying i.e. when the drum rotates slowly - without locking the door-closing mechanism, this device being constituted by a box (40) connectable by two components (41 and 42) which can be plugged firmly into protusions (43 and 44) provided on the outside of
25 the box body (1) of the door-locking device, said microswitch being activated by

means of a push-button (49) which acts on the mobile contact plate (47) of the
aforesaid microswitch and is housed in a hollow cylinder (50) so that it can protrude
outside the box (40), said hollow cylinder being able to be inserted in a hole (51)
drilled in the box body (1) of the door-locking device so that the push-button (49) can
5 come into contact with the sliding bar (15) of the door-locking device which has
been provided with a notch (20) in an appropriate position for receiving one end of
the push-button when the sliding bar is in the off position - the door can be opened
and the machine is stopped - so that, by moving the sliding bar (15), pushed by the
hook (100) of the door latch of the machine, the push-button (49) closes the
10 microswitch.

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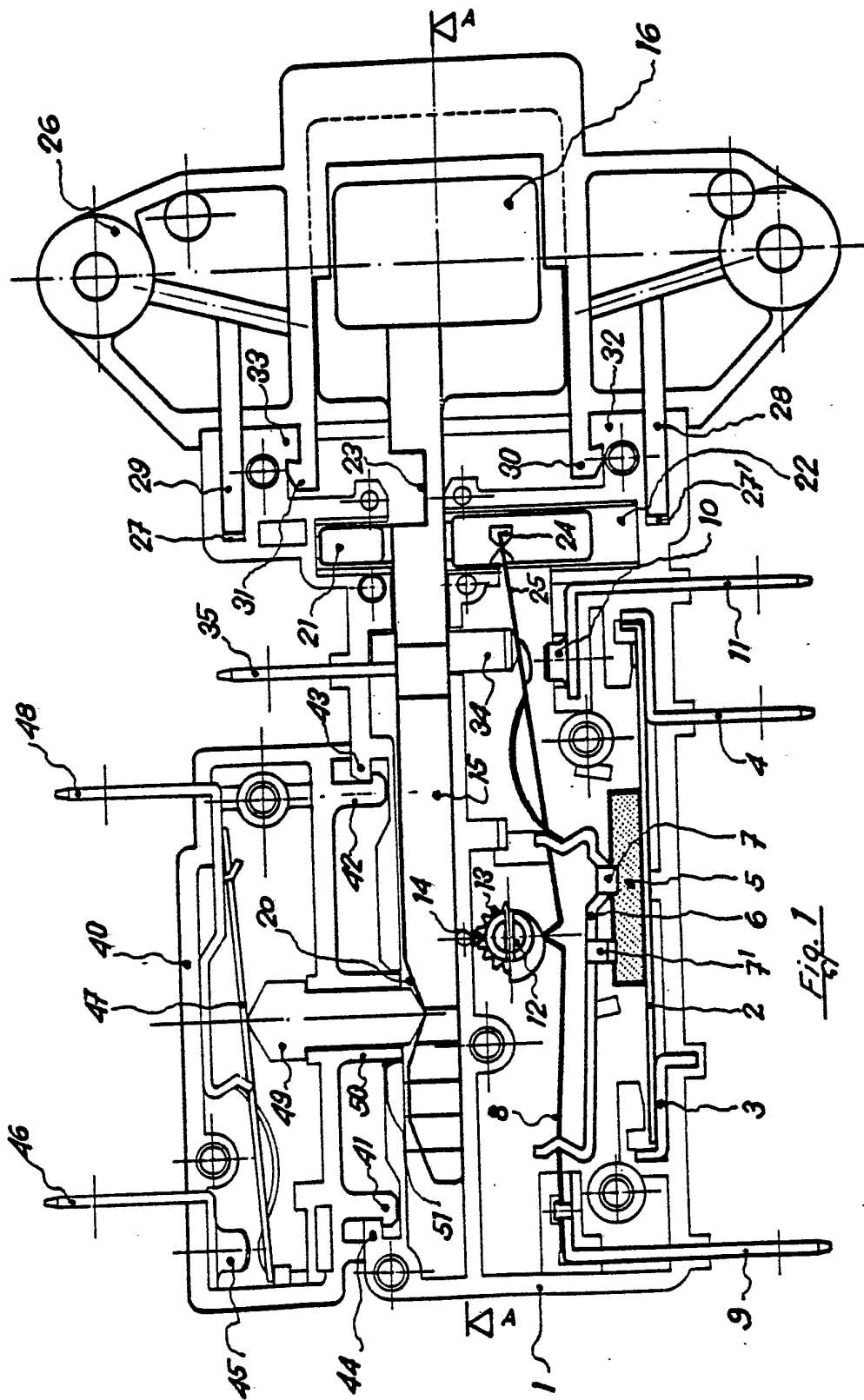


Fig. 1

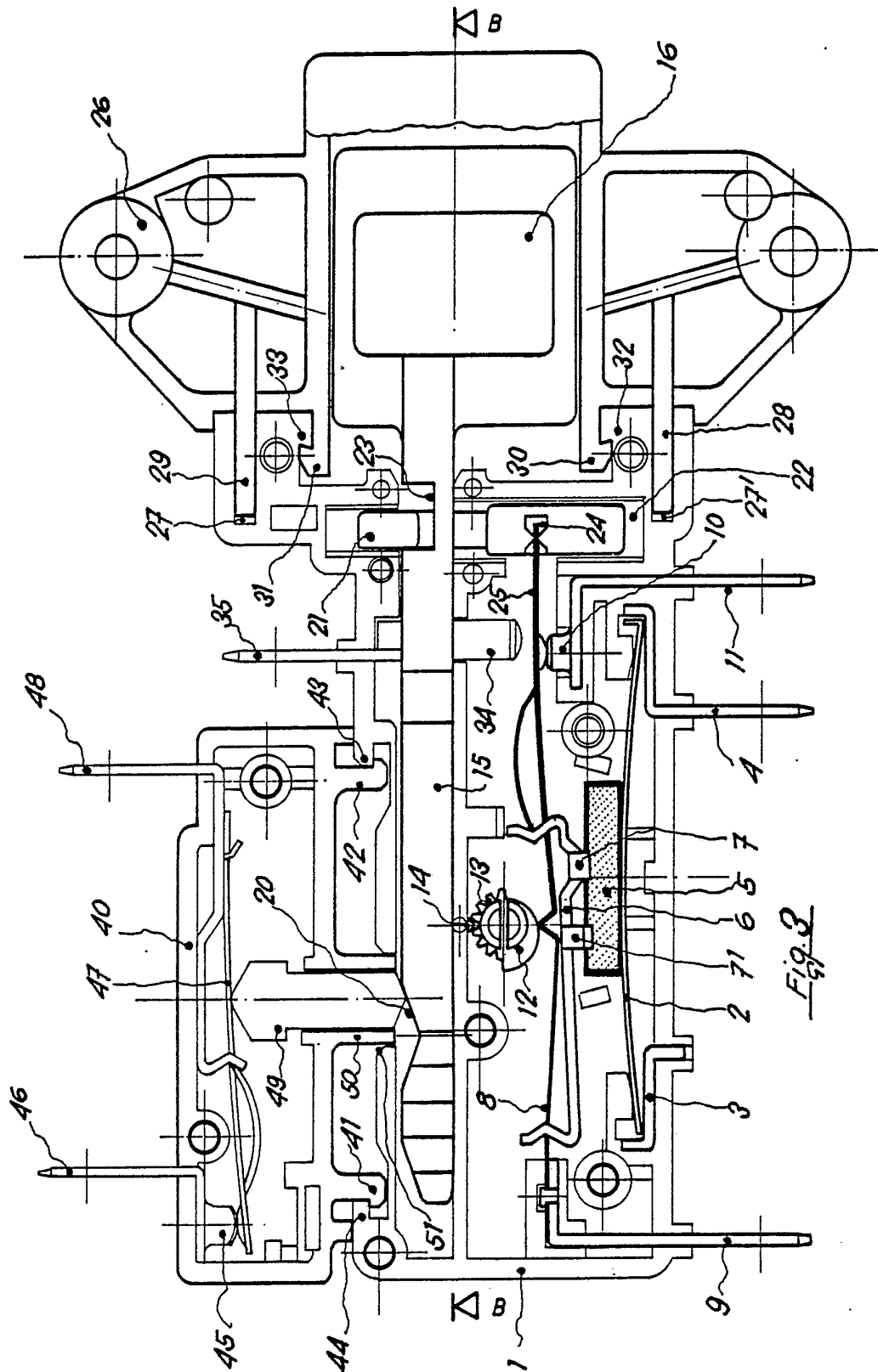
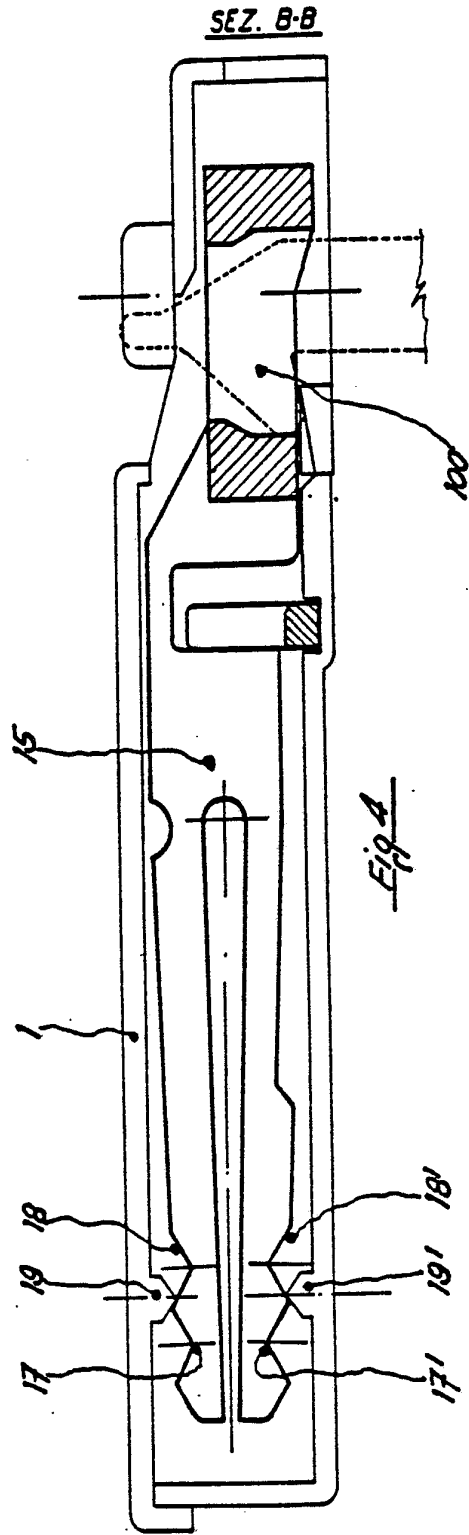
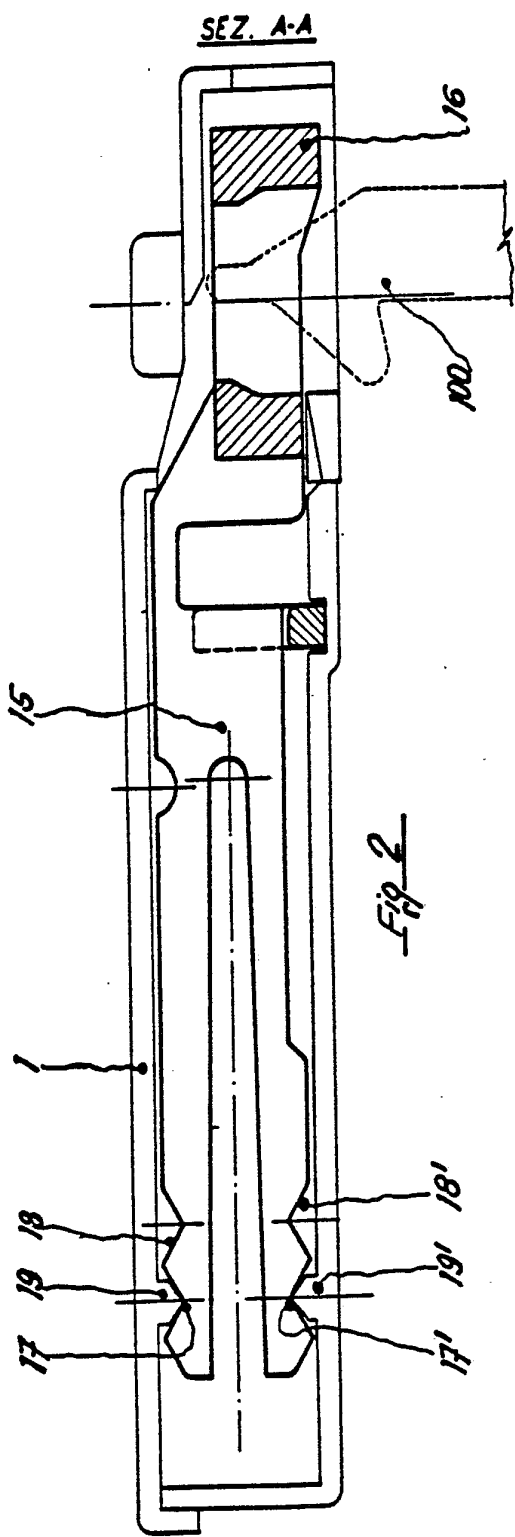



Fig. 3



INTERNATIONAL SEARCH REPORT

International Application No PCT/EP 88/00013

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC ⁴ : D 06 F 37/42		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC ⁴	D 06 F	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category ⁹	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
X	EP, A, 0092162 (ELLENBERGER & POENSGEN GmbH) 26 October 1983, see figures; claims	1,3
A	--	4,5,6
X	FR, A, 2477620 (KIEKERT GmbH & Co KG) 11 September 1981, see figures; claims	1,2
A	--	6
A	US, A, 4262945 (INGLIS LIMITED) 21 April 1981, see figures 7,8	1,2
A	DE, A, 2029262 (FA CARL SIEVERS) 23 December 1971, see figure 2a	6

<p>¹⁰ Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
22nd March 1988	27 APR 1988	
International Searching Authority	Signature of Authorised Officer	
EUROPEAN PATENT OFFICE	 P.C.G. VAN DER PUTTEN	

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.**

EP 8800013
SA 20220

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 18/04/88. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A- 0092162	26-10-83	DE-A- 3214436	27-10-83
FR-A- 2477620	11-09-81	DE-A,C 3008756	17-09-81
US-A- 4262945	21-04-81	None	
DE-A- 2029262	23-12-71	None	