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71 Applicant: I.R.E. Industrie Riunite Eurodomestici S.p.A.

I-21024 Cassinetta di Biandronno (Varese)(IT)

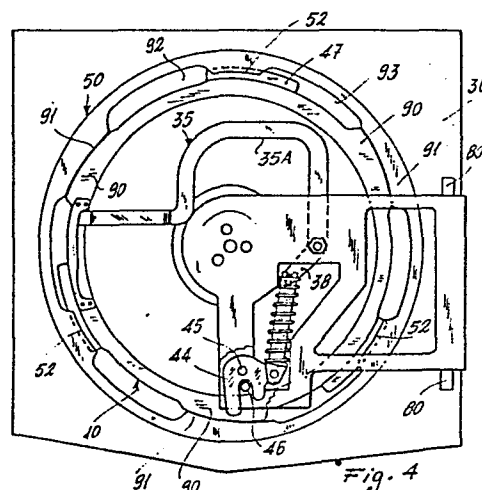
71 Applicant: N.V. Philips' Gloeilampenfabrieken
Groenewoudseweg 1
NL-5621 BA Eindhoven(NL)

72 Inventor: Maretti, Silvano
c/o INT. OCTROOIBUREAU B.V., Prof. Holstlaan 6
NL-5656 AA Eindhoven(NL)

74 Representative: Gorter, Willem Karel et al,
INTERNATIONAAL OCTROOIBUREAU B.V. Prof.
Holstlaan 6
NL-5656 AA Eindhoven(NL)

54 **Device for closing the loading aperture of a washing machine.**

57 The device serves to close the loading and unloading aperture of the tub of a front-loading washing machine. It comprises a door (10) which is rotatably supported on an arm (11) hinged to the tub (5), and is provided peripherally with inclined radial and axial surfaces arranged to cooperate with inclined counter-surfaces associated with the tub in order to restrain the door radially and axially. A lever (35) operated by the user controls the opening and closure of the door, and is loaded by a rocking spring (42).



"Device for closing the loading aperture of a washing machine".

This invention relates to a device for closing the loading and unloading aperture of a front-loading washing machine, particularly for domestic use, in which a stationary structure elastically supports, in a damping
5 manner, a tub containing a driven rotatable drum, and in which the tub and drum have aligned apertures for loading and unloading the laundry.

In known washing machines, the drum is cantilever-supported by the tub, so that because of load eccentricity considerable transverse deformations occur at the
10 very high centrifuging speeds currently used.

In order to reduce these movements, which lead to considerable stressing of the machine parts and resultant reduction in their life, it has already been proposed
15 to also support the drum at its loading aperture side by means of a plate which is inserted into the aperture and which is supported idly so that it can be swivelled, by parts of the washing machine. Thus for example, USA patent 2,105,248 describes a washing machine in which the drum
20 lateral aperture can be closed by a plate idly supported by a swivelling arm hinged to the outer washing machine casing, which here acts as the tub. This plate is elastically applied against the contour of the aperture by a spring disposed in a door which closes the aperture of the
25 outer casing and can be locked in situ by a handwheel.

However, this method is archaic, rudimentary, and requires various manoeuvres for introducing and extracting the laundry into and from the drum, and in addition transfers the oscillations and jolting movements
30 directly to the outer casing of the washing machine and thus to the floor. As a result, the machine in question is unsuitable for operating at centrifuging speeds of 1000 r.p.m. or more.

A further example is contained in USA patent 2,650,490, in which a washing machine without an elastically supported tub comprises a plate which is supported idly by a swivelling cross-member hinged and constrainable to the fixed structure of the machine, and which is inserted into the loading aperture of the drum.

The method in question has a series of drawbacks, including the fact that oscillations and vibrations are transferred to the fixed structure of the machine (giving rise to annoying noise and machine movement), and that it does not ensure perfect closure of the loading aperture because the members which restrain the cross-member in its closed position, and which are limited to a rotatable lever, are too weak to resist the forces to which they are subjected and can easily become released.

The improved device of the invention ensures perfect door closure even under the most difficult operating conditions, prevents the transmission of jolts and oscillations to the washing machine outer structure, offers a further support point for the drum, and enables the door to be opened by the user without force, by simple and natural movements.

These and further objects which will be more apparent from the detailed description given hereinafter are attained by the improved device according to the invention, which is characterized essentially in that the tub loading and unloading aperture is closable by a door which is hinged to said tub and can be coupled to this latter by insertion engagement under the action of a lever supported by the arm, said rotatable door supporting an idly mounted disc element which is inserted into the loading and unloading aperture of the drum so as to oppose transverse movements of this latter which exceed given limits.

The invention will be more apparent from the detailed description of a preferred embodiment given by way of non-limiting example hereinafter with reference to the accompanying drawing, in which:

Figure 1 is a perspective view of the washing machine;

Figure 1A is a partial vertical diametrical section through the drum, the tub which contains it, and the door which closes their loading and unloading apertures;

Figures 2, 3 and 4 are frontal views of three different positions of the door and relative locking mechanism;

Figure 5 is a detail of the mechanism of the preceding figures;

Figure 6 is a linearised, i.e. rectilinearly developed frontal view of that zone of the door lying within the dashed line K of Figure 2; and

Figure 7 is a section on the line VII-VII of Figure 6.

With reference to the Figures, the front-loading washing machine 1 comprises an outer stationary load-bearing structure covered by a housing 2. On its front it comprises an opening 3 closed by a cover 4 which can turn about a lower horizontal axis.

A tub 5, of which the movements are damped by shock-absorber means, not shown, is suspended in known manner by springs (not shown) from the machine supporting structure. In a position corresponding with the opening 3, the tub comprises an aperture 6 surrounded by an elastic seal ring 7 fixed to the tub.

At the opposite side to that comprising the aperture 6, the tub rotatably supports in its interior in the conventional cantilever manner a perforated drum 9 provided with a circular aperture 8 aligned with said aperture 6. The laundry is loaded into and unloaded from the drum through the opening 3, the aperture 6, and the aperture 8.

The aperture 6 of the tub 5 can be closed by a door 10 rotatably supported by an arm 11 which will be described in detail hereinafter. The door in question rotatably supports a sheet metal disc element 12 having a

substantially cylindrical contour 13 of diameter slightly less than the diameter of the circular aperture 8. The disc element 12 is arranged for insertion into the aperture 8, and peripherally comprises a turned-over rim 14, of which the end is applied against the contour of said aperture 8. The sheet metal element 12 is made rigid in any known manner with a plate 15 of lesser diameter but greater rigidity, which is rigid with a pin 16 rotatably mounted in a bearing 17. The bearing is mounted in the hub 18 of the door 10.

On an annular step 20 of the plate 15 there is fixed an annular gasket 21 with elastic edges, one of which adheres in a sealed manner to the inner contour of a centrally holed annular sheet metal member 22, of which the contour, which is initially conical and then arcuate at 23, is situated but not locked in a circular groove in the door 10. In a sunken zone in proximity to its centre, the disc in question comprises a series of pins 24 fixed in a circular arrangement parallel to the axis of rotation of the element 12 and each having a radial projection 25 which is disposed slackly in an annular channel 26 obtained by fixing to the door 10 a sheet metal ring 27 of Z cross-section.

The gasket 7 cooperates with the conical part of the contour 23 of the disc 22 to create an effective peripheral seal towards the outside, while the internal seal is provided by the elastic edge of the annular gasket 21, which for this purpose adheres to the inner contour of the disc 22.

The purpose of this special coupling arrangement between the disc 22 and door 10 is to reduce the tangential sliding between the disc and gasket 7 when closing and opening the door, and thus to increase the gasket life.

As stated, the door 10 is rotatably supported by an arm 11 hinged to the front wall 30 of the tub 5 so that it can be swivelled horizontally about the hinges 80. The support for the door 10 can be provided by means of a pin 31 fixed to said door, a bearing 32 mounted on the

pin 31, and a hub 33 fixed to the arm 11. A lever 35 is pivoted at 34 on the arm 11 and comprises a raised part 36 (to be gripped by the hand) followed by a sunken end 96 which is disposed below a guide plate 37 fixed to the outer wall of the door 10.

The lever 35 is rigid with a short arm 38 which terminates in a transverse pin 39. The pin penetrates into an axial slot 40 in a bar 41, and acts as a stop for one end of a compression spring 42 mounted on said bar.

The other end of the spring 42 rests against a fork 43 rigid with the bar 41. The fork is hinged to an appendix of a pawl 44, which is hinged at 45 to the arm 11. A locking peg 46 rigid with the door 10 is arranged to cooperate with said pawl.

Distributed along its periphery, the door 10 comprises a set of three equidistant projections 47 of limited angular and axial extension and which are wedge-shaped over a certain portion (see Figure 7). Axially and angularly spaced apart from the projections 47, the door comprises three radial projections 90 of wedge-shaped outer surface.

On its front side, and extending completely around its aperture 6 but spaced-apart from the corresponding wall 30, the tub 5 supports a ring 50 which surrounds the door 10 and is shaped in such a manner as to comprise a set of three equidistant radial projections 52, and a set of three wedge-shaped radial projections 91 which are equidistant from each other and from said projections 52. Between the projections 52 and 91 there are recesses 92 and 93 which enable the door 10 to be moved against the aperture 6 of the tub 5, i.e. in correspondence with the annular interspace or channel 70 existing between the ring 50 and the front wall 30 of the tub 5 (see Figures 1A and 7).

It will be assumed that the arm 11 is in its outwardly rotated position so that the door 10 and the other members carried by said door allow free access to the drum 9, which can thus be loaded with laundry. After

loading, the user rotates the arm 11 about the vertical hinges 80 so that the disc element 12 becomes inserted into the aperture 8 of the drum 9, and the door 10 into the aperture 6 of the tub, to assume the position shown in Figures 1 and 2.

In order to close said apertures and reliably lock the door 10 and its accompanying members in situ, the user grips the lever 35 along the raised portion 36, and rotates it in the direction of the arrow F of Figure 2. During its initial stages, said rotation causes increased compression of the spring 42. Then (see Figure 3) when the end 96 of the lever 35 engages the end 81 of the plate 37, the door 10 is dragged into rotation, and its projections 47 move along the channel 70, and the pin 46 reaches the longer side of the pawl 44. As rotation continues, the projections 47 of the door 10 become wedged in the channel 70 behind the radial projections 51 of the ring 50, the wedge-shaped projections 90, 91 engage with each other, and the pin 46 (see Figure 4) causes rotation of the pawl 44, which imprisons said pin between its arms, and stops when the two projections 90 and 91 touch each other. The door 10 thus becomes axially and radially locked in its closed position. During the centrifuging of the drum 9, the jolting and displacements of the free end of the drum 9 are limited by the support which the contour of the aperture 8 finds on the cylindrical peripheral part of the element 12 inserted into the aperture 8, and this jolting is in no case able to cause opening of the door, which the spring 42 securely locks in its closed position.

When the user wishes to unload the washed laundry from the drum, he grips the lever 35 at 36 and rotates it in the opposite direction to the arrow F.

Until the lever engages with the other end 82 of the plate 37, the only effect obtained is to reduce the loading of the spring 42. After engagement with the end 82 of the plate 37, further rotation of the lever 35 causes rotation of the pawl 44 under the thrust of the pin 46 rigid with the door 10. The pawl thus snaps into

the position of Figures 2 and 5, and the spring 42 aids the rotation of the door.

When this rotation is terminated by virtue of the engagement of the elbow 35A of the lever 35 with the contour of the hub 33, the projections 47 are aligned with the recesses 92 of the ring 50, and the wedge-shaped projections 90 are aligned with the recesses 93, with the result that the door 10 can be opened by rotating the arm 11 about the hinges 80. This rotation of the arm 11 causes extraction of the disc 22 from the aperture 6 by virtue of the engagement of the teeth 25 with the ring 26. The disc 22 has not participated in the described rotations of the door 10, and thus there has been no relative circumferential movement between it and the gasket 7, which is thus protected from rubbing and from rapid wear.

Although only one embodiment of the invention has been described, it will be simple for an expert of the art, in possession of the inventive idea, to make numerous modifications, which however must all lie within the scope of the invention itself.

PATENT CLAIMS.

1. A device for closing the loading and unloading apertures of a front-loading washing machine, particularly for domestic use, in which a stationary structure elastically supports, in a damping manner, a tub containing a driven rotatable drum, and in which the tub and drum have aligned apertures for loading and unloading the laundry, characterized in that the aperture for loading and unloading the tub is closable by a door which is rotatably mounted on an arm hinged to said tub and can be coupled to this latter by insertion engagement under the action of a lever supported by the arm, said rotatable door supporting an idly mounted disc element which is inserted into the loading and unloading aperture of the drum so as to oppose transverse movements of this latter of a given extent.
2. A device as claimed in claim 1, characterized in that the door carries a pin arranged to engage with a snap-acting locking pawl which is supported by the arm, and of which the operation is controllable by the lever.
3. A device as claimed in claim 2, characterized in that the lever cooperates with bidirectional dragging means to cause rotation of the door.
4. A device as claimed in claim 3, characterized in that the bidirectional dragging means are represented by a stirrup-shaped member which receives one end of the lever and is rigid with the door.
5. A device as claimed in claim 1, characterized in that the door comprises a profiled periphery for the insertion engagement with profiled counter-means rigid with the tub and situated around the door.

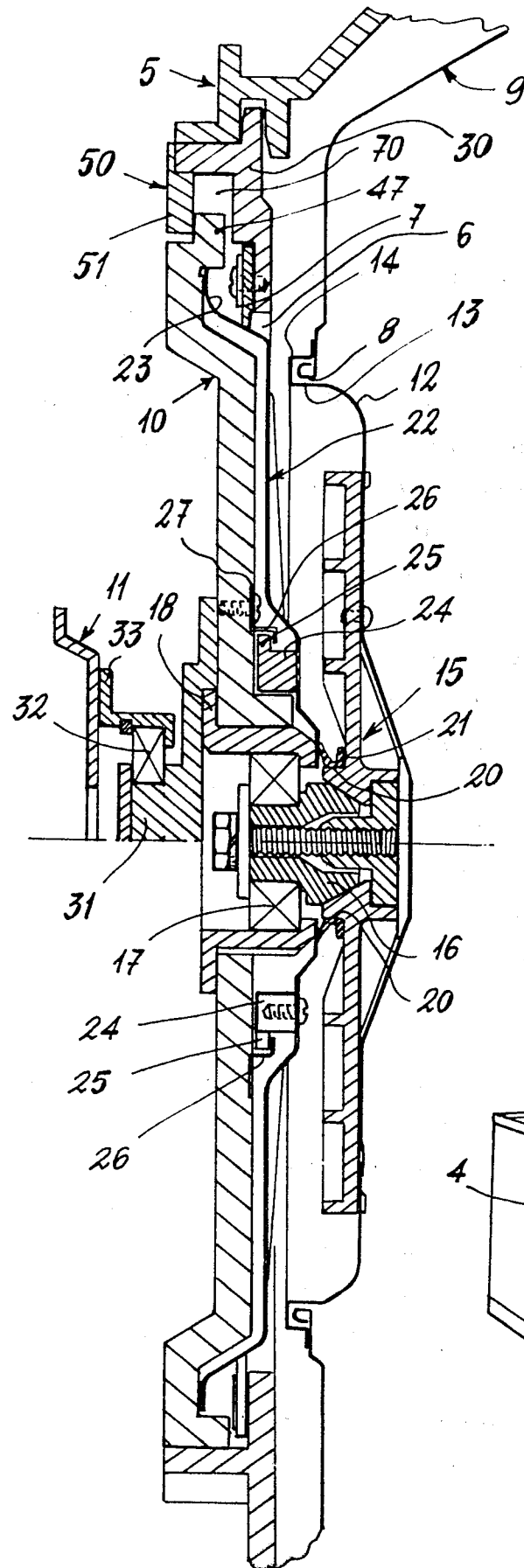


Fig. 1A

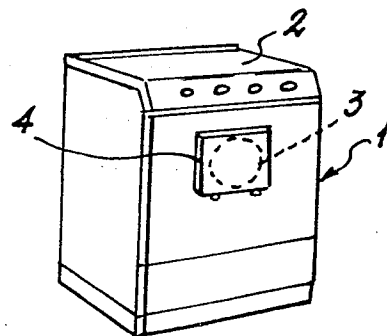
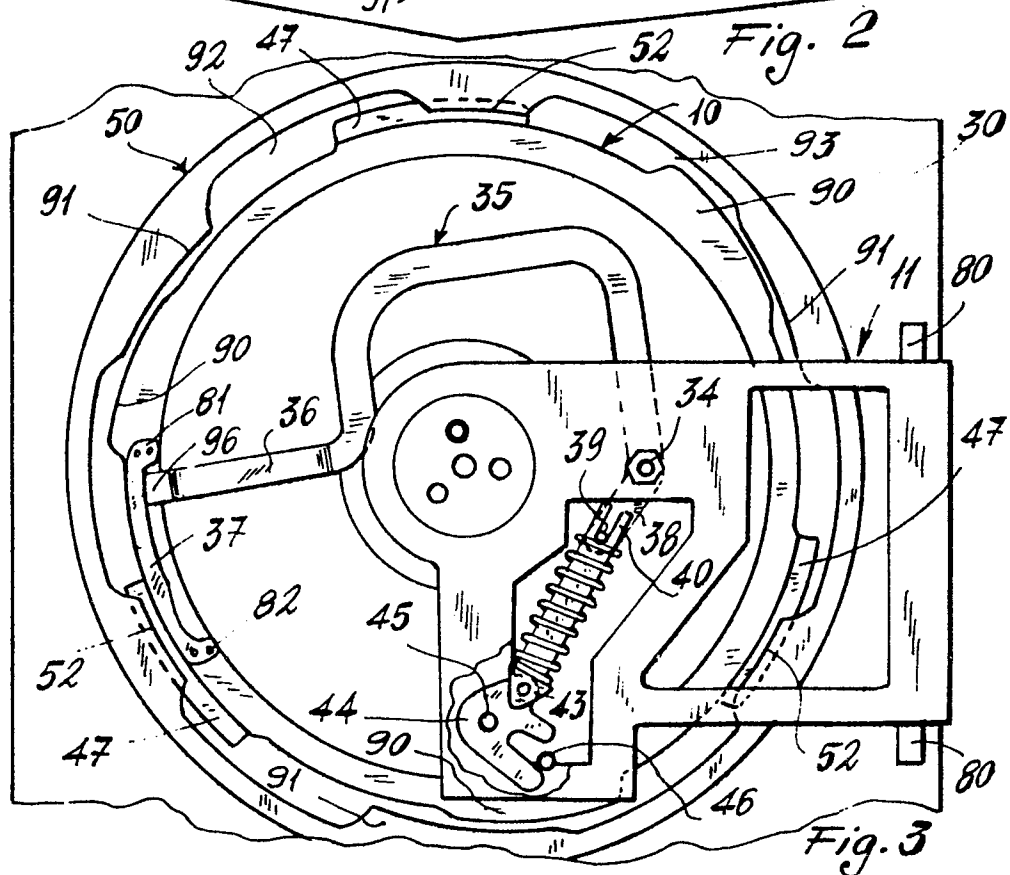
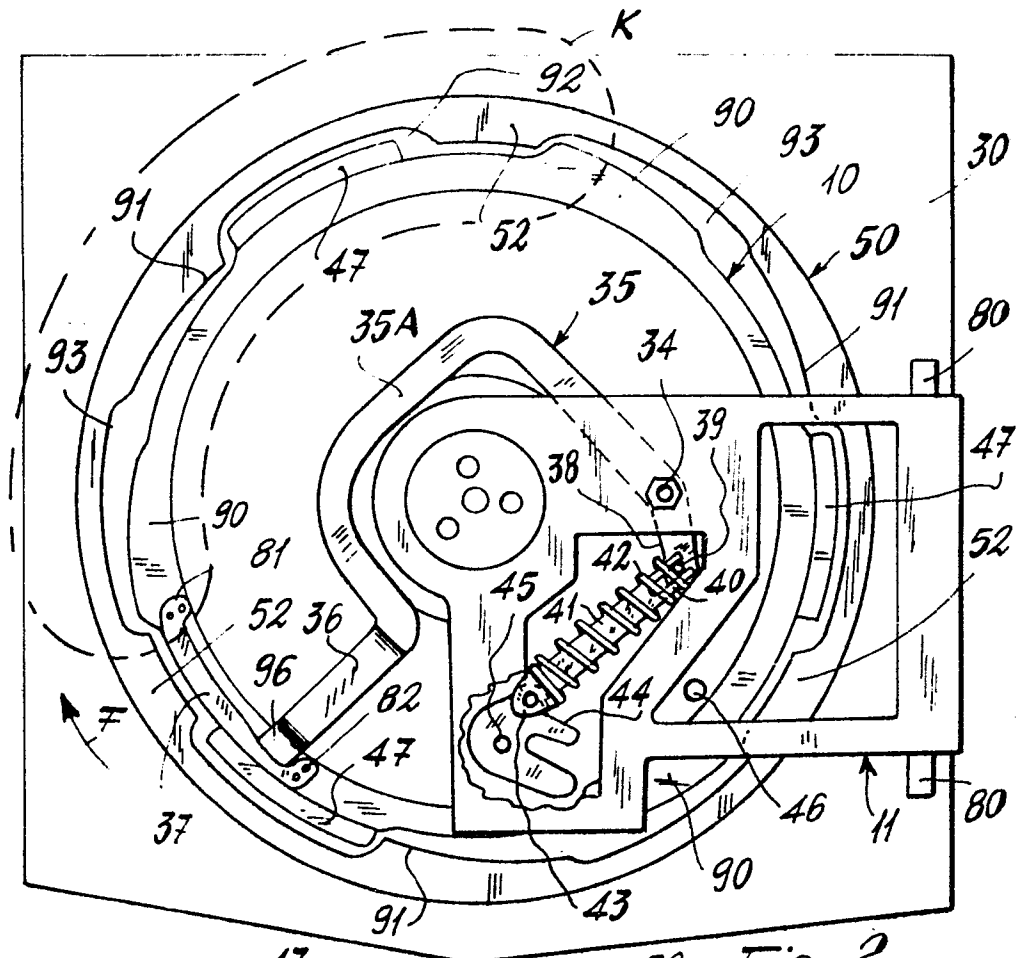
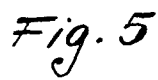
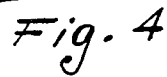
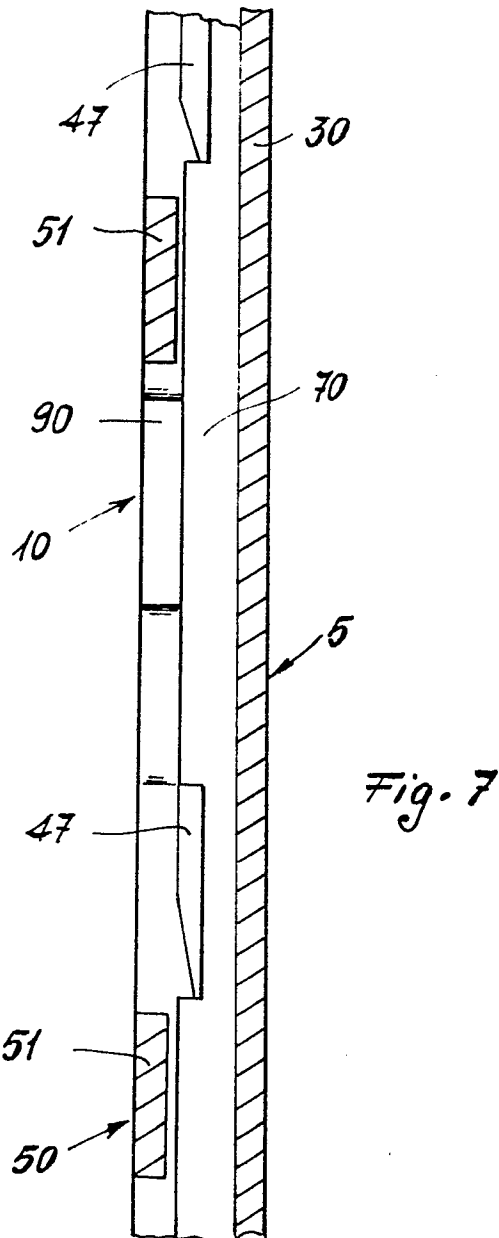
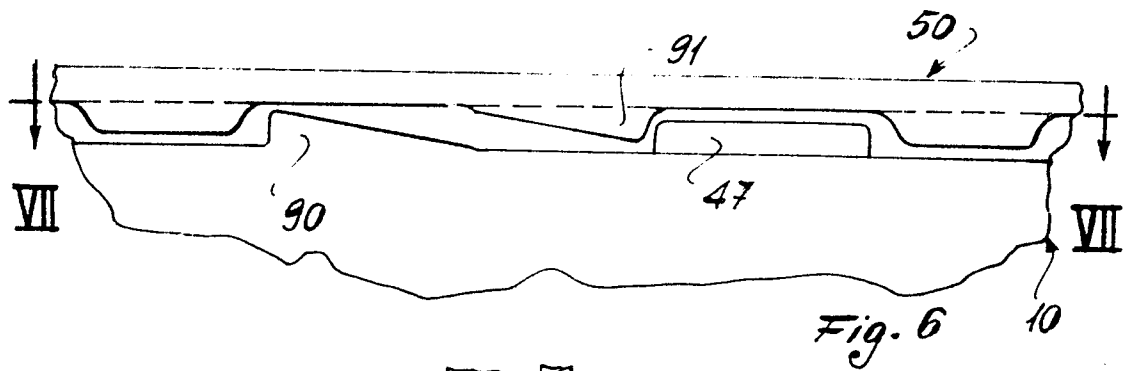


Fig. 1









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. 3)
A	DE-C-1 034 129 (SIEMENS)		D 06 F 37/28

A	US-A-1 765 207 (COFFEE)		

D,A	US-A-2 650 490 (GLASSEY)		

D,A	US-A-2 105 248 (JOHNSON)		

			TECHNICAL FIELDS SEARCHED (Int. Cl. 3)
			D 06 F 37/00
The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 14-08-1984	Examiner KLITSCH G
CATEGORY OF CITED DOCUMENTS		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	
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			