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(54) **Household laundry washing and/or drying appliance**

(57) A household laundry washing and/or drying appliance (1) having an outer box casing (2), and a substantially cylindrical bell-shaped revolving drum (3) for housing the laundry to be washed and/or dried, and which is mounted for rotation about its longitudinal axis (L) inside the box casing (2); the revolving drum (3), in turn, having a substantially cylindrical outer supporting vessel

(5) extending coaxially with the longitudinal axis (L) of the drum, and a substantially cylindrical liner (6) covering the inner cylindrical surface (5b) of the supporting vessel (5); the liner (6) being defined by a cylindrical sleeve (7) of polypropylene mixed with calcium carbonate, and by a protective film (8) of bi-oriented polypropylene lining the inner surface (7a) of the sleeve (7).

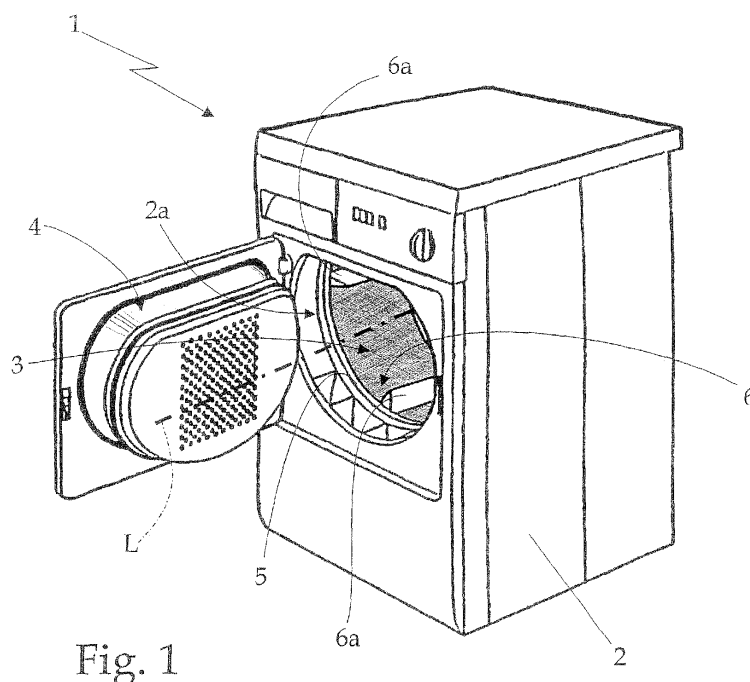


Fig. 1

Description

[0001] The present invention relates to a household laundry washing and/or drying appliance.

[0002] More specifically, the present invention relates to a rotary-drum home laundry drier, to which the following description refers purely by way of example.

[0003] As is known, rotary-drum laundry driers usually comprise a substantially parallelepiped-shaped outer box casing; a cylindrical bell-shaped drum for housing the laundry to be dried, and which is housed in axially rotating manner inside the casing to rotate about a horizontal longitudinal axis, and directly facing a laundry loading and unloading opening formed in the front face of the casing; a door hinged to the front face of the casing to rotate to and from a rest position closing the opening in the front face of the casing to seal the casing and the bell-shaped drum; and an electric motor for rotating the laundry drum about its longitudinal axis inside the casing.

[0004] Rotary-drum laundry driers of the above type also comprise a closed-circuit, hot-air generator designed to circulate inside the bell-shaped drum a stream of hot air with a low moisture content, and which flows through the bell-shaped drum and over the laundry inside the drum to rapidly dry the laundry.

[0005] Though highly efficient, the high noise level of rotary-drum laundry driers in certain operating conditions has been the object of frequent criticism over the past few years.

[0006] More specifically, in recent years, users of rotary-drum laundry driers have voiced complaints about the annoying tinkling sound produced by metal parts in the laundry continually striking the cylindrical wall of the laundry drum, which has always been made of stainless steel.

[0007] The reason for these complaints lies in the fact that the noise produced by metal parts in the laundry striking the cylindrical wall of the bell-shaped drum normally has higher acoustic frequencies than the other noises produced when the appliance is running, and very often falls within the acoustic frequency spectrum to which the human ear is more sensitive, thus making it particularly annoying.

[0008] Moreover, the acoustic frequencies of the noise produced by metal parts in the laundry striking the cylindrical wall of the drum are normally amplified by the casing, which acts as a resonator, with all the drawbacks this entails.

[0009] It is the aim of the present invention to provide a rotary-drum home laundry drier designed to eliminate the aforementioned drawbacks.

[0010] According to the present invention, there is provided a household appliance as claimed in Claim 1 and preferably, though not necessarily, in any one of the Claims depending directly or indirectly on Claim 1.

[0011] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which :

Figure 1 shows a view in perspective, with parts removed for clarity, of a rotary-drum laundry drier in accordance with the teachings of the present invention;

Figure 2 shows a view in perspective, with parts in section and parts removed for clarity, of a detail of the Figure 1 rotary-drum laundry drier;

Figure 3 shows a section of part of the drum of the Figure 1 rotary-drum laundry drier.

[0012] Number 1 in the attached drawing indicates as a whole a household laundry washing and/or drying appliance comprising a preferably, though not necessarily, parallelepiped-shaped outer box casing 2; a preferably, though not necessarily, cylindrical bell-shaped revolving drum 3 for housing the laundry to be washed and/or dried, and which is housed in axially rotating manner inside casing 2, directly facing a laundry loading and unloading opening 2a formed in the front face of casing 2; and a door 4 hinged to the front face of casing 2 to rotate to and from a rest position closing opening 2a in the front face to seal casing 2 and drum 3.

[0013] More specifically, in the example shown, household appliance 1 is a home laundry drier, and revolving drum 3 rests horizontally inside casing 2 on a number of horizontal supporting rollers (not shown) fitted to casing 2 to allow drum 3 to rotate freely about its longitudinal axis L.

[0014] Laundry drier 1 also comprises an electric motor assembly (not shown) or similar, which, on command, rotates drum 3 about longitudinal axis L inside casing 2; and a closed-circuit, hot-air generator (not shown) housed inside casing 2 and designed to circulate inside drum 3 a stream of hot air with a low humidity content, and which flows over, to rapidly dry, the laundry inside the drum.

[0015] Casing 2, door 4, the supporting rollers of drum 3, the electric motor assembly, and the hot-air generator are commonly known parts in the industry, and therefore not described in detail.

[0016] With reference to Figures 1 and 2, unlike known home laundry driers, revolving drum 3 of laundry drier 1 comprises a substantially cylindrical bell-shaped outer supporting vessel 5 extending coaxially with longitudinal axis L of the drum, with its outer cylindrical surface 5a resting on the supporting rollers of drum 3; and a substantially cylindrical liner 6 made of plastic material and fixed firmly to the inner cylindrical wall of supporting vessel 5 to fully cover the inner cylindrical surface 5b of vessel 5.

[0017] More specifically, with reference to Figures 2 and 3, vessel 5 is preferably, though not necessarily, made of metal (for example, stainless steel or zinc-coated iron), and has an end wall 5c at least partly perforated or at any rate permeable to air, to assist airflow into revolving drum 3; and liner 6 rests on the cylindrical wall of vessel 5, and comprises a cylindrical sleeve 7 of polypropylene mixed with calcium carbonate and other op-

tional additives and/or pigments, and a protective film 8 of bi-oriented polypropylene lining the inner surface 7a of sleeve 7, i.e. the surface of sleeve 7 facing the center of revolving drum 3.

[0018] More specifically, protective film 8 is made of bi-oriented polypropylene having an ultimate strength ranging between 100 N/mm² (Newton per square millimeter) and 170 N/mm² (Newton per square millimeter) according to ASTM International standard measuring method D 882-91.

[0019] In the example shown, the thickness of cylindrical sleeve 7 preferably, though not necessarily, ranges between 3 and 15 millimeters; and the thickness of protective film 8 is preferably, though not necessarily, less than 0.5 millimeters.

[0020] In addition, as shown in Figure 2, liner 6 is divided into a number of rigid, cylindrical-sector-shaped shells 6' having the shape of cylindrical sectors, and which are placed adjacent to one another inside vessel 5, with appropriate clearance between shells 6' to compensate thermal expansions, to fully cover the inner cylindrical surface 5b of vessel 5. Each rigid shell 6' is secured firmly to the cylindrical wall of vessel 5 by a number of screws, rivets or other fastening means (not shown), and comprises a substantially rectangular sheet 7 of polypropylene mixed with calcium carbonate and other optional additives and/or pigments; and a protective film 8 of bi-oriented polypropylene lining the inner surface 7a of sheet 7, i.e. the surface of sheet 7 not facing the cylindrical wall of supporting vessel 5.

[0021] As stated, the thickness of cylindrical sheets 7 preferably, though not necessarily, ranges between 3 and 15 millimeters; and the thickness of protective films 8 is preferably, though not necessarily, less than 0.5 millimeters.

[0022] Finally, with reference to Figures 1 and 2, liner 6 preferably, though not necessarily, comprises a number of inner projecting ribs 6a projecting radially towards the centre of drum 3. In the example shown, ribs 6a extend substantially parallel to longitudinal axis L of drum 3, and are equally spaced angularly along the whole circumference of liner 6.

[0023] General operation of laundry drier 1 is clearly inferable from the above description, with no further explanation required, other than to state that liner 6 prevents metal parts in the laundry rotating in drum 3 from directly striking the cylindrical lateral wall of vessel 5, thus eliminating the noise typical of metal-on-metal impact.

[0024] The design of revolving drum 3 has numerous advantages: the cylindrical sleeve 7 of polypropylene mixed with calcium carbonate - commonly known as "Eurocorboran" - is extremely cheap, rigid, and resistant to mechanical stress; and protective film 8 of bi-oriented polypropylene, though slightly dearer than "Eurocorboran", is highly scratch-resistant, and provides for a highly attractive, high-quality surface finish as demanded by users.

[0025] In addition, the fact that sleeve/sheet 7 and pro-

ductive film 8 are made of the same basic plastic polymer (i.e. polypropylene) provides for perfect, permanent adhesion of the two plastic materials, thus enabling low-cost production of rigid shells 6'. Liner 6, in fact, can be produced easily using in-molding or over-molding production processes: protective film 8 is placed inside the mold chamber, and Eurocorboran is injected over it.

[0026] Revolving drum 3 is therefore cheaper than traditional laundry drying drums made entirely of stainless steel.

[0027] Finally, by virtue of the elastic modulus of polypropylene mixed with calcium carbonate, cylindrical sleeve 7 greatly reduces the noise produced by metal parts in the laundry striking liner 6, thus greatly reducing the noise level of the appliance.

[0028] Clearly, changes may be made to household appliance 1 as described herein without, however, departing from the scope of the present invention.

[0029] For example, household appliance 1 may comprise a preferably, though not necessarily, cylindrical bell-shaped, air- or watertight tub fixed substantially horizontally inside casing 2, directly facing the laundry loading and unloading opening 2a, and revolving drum 3 is housed in axially rotating manner inside the air- or watertight tub.

[0030] In an alternative embodiment, liner 6 may be made of other polypropylene-based plastic materials.

Claims

1. A household appliance (1) comprising an outer box casing (2), and a substantially cylindrical bell-shaped revolving drum (3) for housing the laundry to be washed and/or dried, and which is mounted for rotation about its longitudinal axis (L) inside said box casing (2); the household appliance (1) being **characterized in that** said revolving drum (3) comprises a substantially cylindrical outer supporting vessel (5) extending coaxially with the longitudinal axis (L) of the drum; and a substantially cylindrical liner (6) covering the inner cylindrical surface (5b) of the supporting vessel (5); said liner (6) comprising a cylindrical sleeve (7) of plastic material, and a protective film (8) of bi-oriented polypropylene lining the inner surface (7a) of the sleeve (7).
2. A household appliance as claimed in Claim 1, wherein the cylindrical sleeve (7) of said liner (6) is made of a polypropylene-based plastic material.
3. A household appliance as claimed in Claim 2, wherein the cylindrical sleeve (7) of said liner (6) is made of polypropylene mixed with calcium carbonate.
4. A household appliance as claimed in any one of the foregoing Claims, wherein the supporting vessel (5) of said liner (6) is substantially cylindrical bell-

shaped.

5. A household appliance as claimed in Claim 4, wherein the substantially cylindrical bell-shaped supporting vessel (5) is made of metal. 5
6. A household appliance as claimed in any one of the foregoing Claims, wherein said liner (6) is divided into a number of rigid, cylindrical-sector-shaped shells (6') fixed adjacent to one another inside the supporting vessel (5) to fully cover the inner cylindrical surface (5b) of said supporting vessel (5). 10
7. A household appliance as claimed in Claim 6, wherein each rigid shell (6') is secured firmly to the supporting vessel (5) by screws, rivets or other fastening means. 15
8. A household appliance as claimed in any one of the foregoing Claims, wherein the thickness of said cylindrical sleeve (7) ranges between 3 and 15 millimeters. 20
9. A household appliance as claimed in any one of the foregoing Claims, wherein the thickness of said protective film (8) is less than 0,5 millimeters. 25
10. A household appliance as claimed in any one of the foregoing Claims, wherein said household appliance (1) is a laundry drier. 30
11. A household appliance as claimed in any one of the foregoing Claims, wherein said protective film (8) is made of bi-oriented polypropylene having an ultimate strength ranging between 100 N/mm² and 170 N/mm². 35

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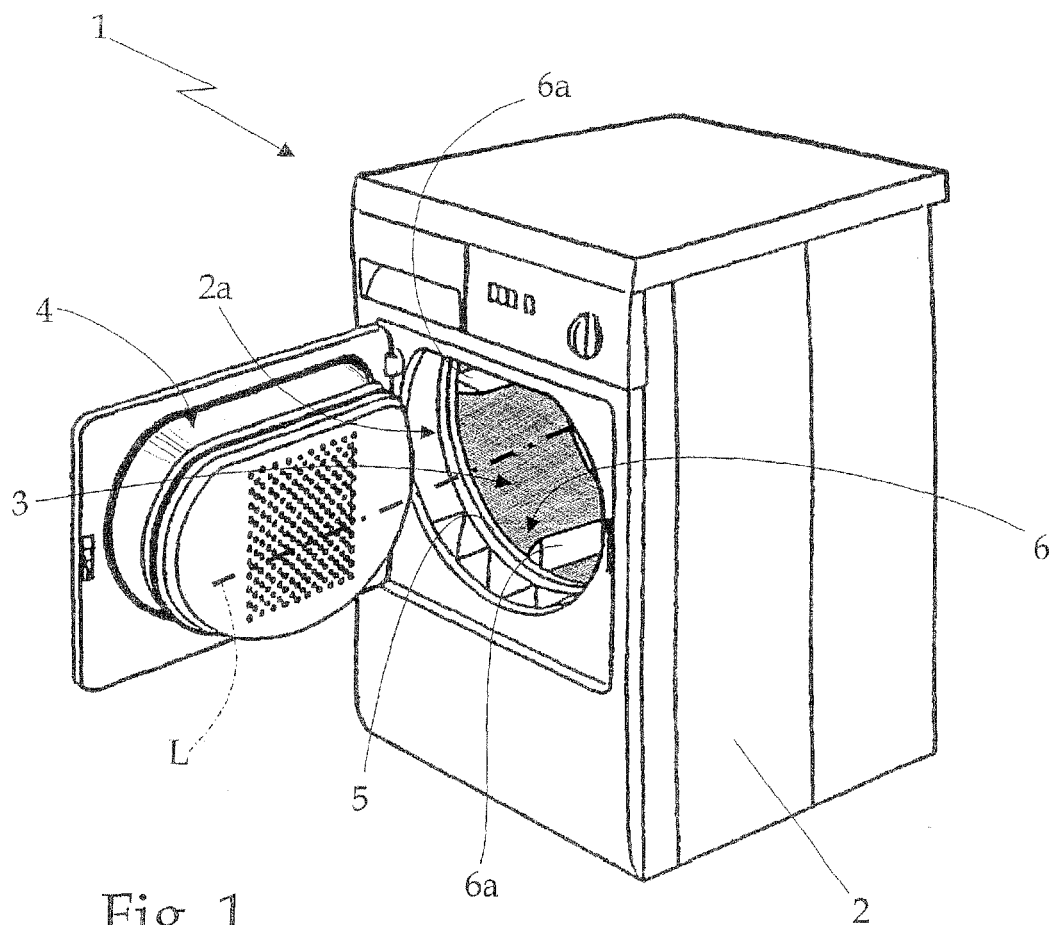


Fig. 1

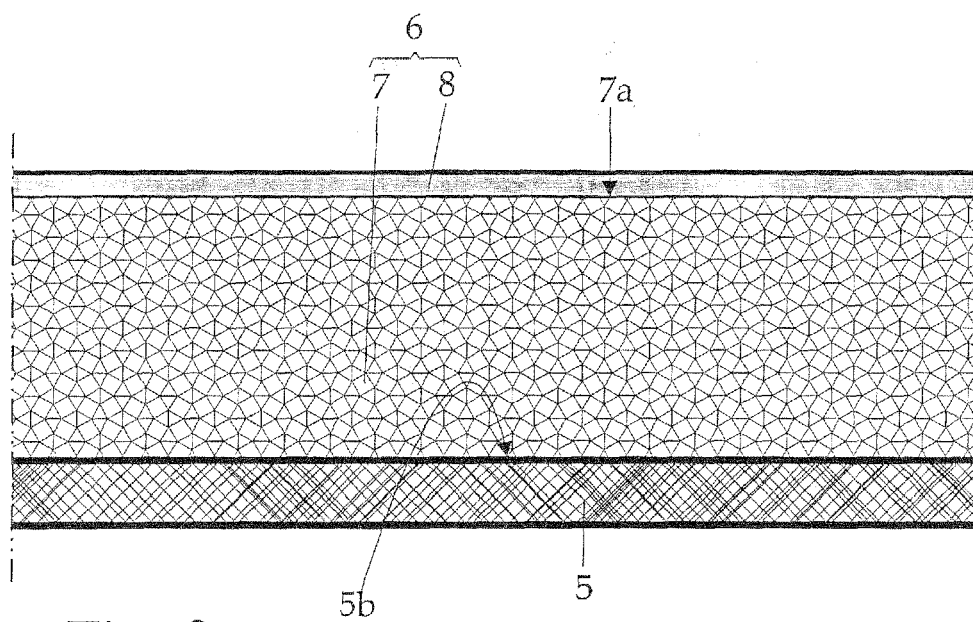
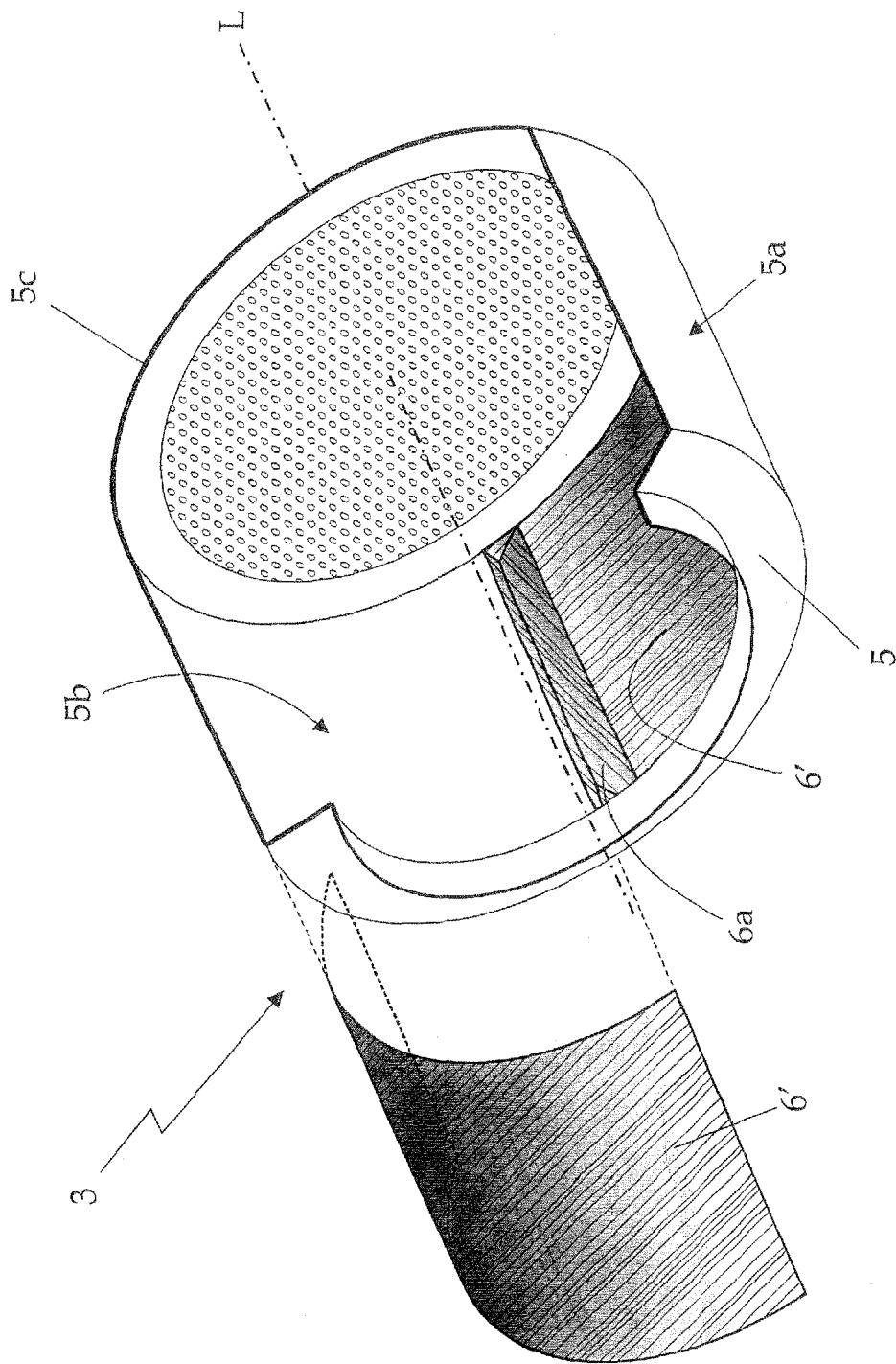


Fig. 3



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EUROPEAN SEARCH REPORT

Application Number
EP 08 15 4120

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 1 666 657 A (ELECTROLUX HOME PROD CORP [BE]) 7 June 2006 (2006-06-07) * paragraph [0020]; figures *	1	INV. D06F58/04 D06F37/02
A	EP 1 541 741 A (LG ELECTRONICS INC [KR]) 15 June 2005 (2005-06-15) * paragraphs [0056], [0057]; claim 1 *	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			D06F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 7 November 2008	Examiner Stroppa, Giovanni
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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

EP 08 15 4120

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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07-11-2008

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 1666657	A	07-06-2006	NONE	
EP 1541741	A	15-06-2005	US 2005120585 A1	09-06-2005