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(54) **Process for drying laundry, or the like, in washer-driers, or the like**

Verfahren zum Trocknen von Wäsche oder dergleichen in einem Waschtrockner oder dergleichen

Procédé pour sécher du linge ou similaire dans une machine à laver et à sécher ou similaire

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## Description

**[0001]** The invention relates to a process for drying laundry, or the like, in washer-driers and driers, or the like, according to the preamble of claim 1.

**[0002]** In known driers, and particularly in known washer-driers, the rotating drums are not very large and the laundry occupies almost the entire available space. In addition, the type of drum movement currently employed, in which the drum has phases of rotation at a predetermined speed and in one direction only, alternating with pauses, does not agitate and lift the laundry sufficiently to ensure the formation of considerable spaces through which the hot drying air can pass. The difficulty the hot air has in traversing the laundry reduces the efficiency of the drying process, which is consequently made slower. Known processes therefore involve relatively long drying times.

**[0003]** Moreover, the dimensions of the drum cannot be increased at will and must be kept within certain limits if the machines are not to become too large, which would be a serious inconvenience, especially for machines intended for domestic use.

**[0004]** Document EP-A-761 discloses a process according to the preamble of claim 1. During the drying cycle, the drum is driven at a rotational speed which is higher than the speed normally used. The drying cycle comprises several phases during each of which phase the rotational speed of the drum is different relatively to the rotational speed of the following phase. Advantageously the rotational speeds of the different phases may be higher, similar or lower than the drying rotational speed.

**[0005]** Document CH-A-659841 discloses also a method for drying laundry. The method taught therein aims to reduce the mechanical stress on the laundry during drying and provides a variation of the revolution of the drum during the drying process. This variation consists in a reduction of the rotational speed from a first higher speed to a second lower speed. The rotational speed may be reduced step by step.

**[0006]** The object of the invention is to provide a drying process that can be used in present-day driers and in particular in present-day washer-driers, that will increase the efficiency of the drying phase and therefore making it shorter, without requiring structural modifications to the actual machines.

**[0007]** The invention achieves the above objects by means of a process for drying laundry, or the like, in washer-driers or driers, or the like, of the type according to the preamble of claim 1 and which further comprises the combination of steps according to the characterising part of claim 1.

**[0008]** The speed of movement of the laundry is selected such that when the movement stops for the pause, the laundry is tumbled, whereas during the movement the inertial forces do not cause excessive compression and compacting of the said laundry.

**[0009]** The speed of movement of the laundry during the drying phase is faster than its speed during washing by approximately a factor of up to 3.

**[0010]** The speeds of movement of the laundry may be variable to suit the types of fabric being handled.

**[0011]** In addition to varying the speed of the motion of agitation/movement of the laundry, it is also possible for the program of alternating movement between the successive phases of movement of the drying process to be varied in accordance with any program.

**[0012]** During the spinning phase, normally only some 50% of the water is removed. This means that faster speeds of movement can be used during the subsequent drying phase without running the risk that the inertial effect produced by the motion on the mass of water still held within the laundry will cause it to be too heavily compressed and hence compacted. As the drying process proceeds, the mass of water held within the laundry gradually decreases so that the speed of movement is increased without the danger of excessive compression and hence of excessive compacting of the laundry.

**[0013]** The invention relates in particular and by way of example to an embodiment of the drying process used in conjunction with driers and/or washer-driers having a cylindrical drum with a horizontal axis of rotation, such as are conventionally used at present, but may be extended with no particular ingenuity to machines in which the drum rotates on a vertical axis and to any other type of washing machine and/or drier with laundry agitating cycles.

**[0014]** In particular, when using drums rotating on a horizontal axis of rotation, the movement of the laundry is achieved by an alternating rotation of the drum in both clockwise and anticlockwise directions.

**[0015]** The alternating rotation, referring to the two opposite directions of rotation, can be achieved by any method. For example, one possibility is an oscillating motion of the drum in both directions of rotation without the drum ever actually completing a full revolution in either direction.

**[0016]** Alternatively, the drum may be rotated one or more times without interruption in one direction and one or more times in the opposite direction directly following on.

**[0017]** As an alternative, it is also possible to perform several rotations in one direction and several rotations in the opposite direction for each phase of movement of the laundry, each rotation or several rotations in one direction being followed by one or more rotations in the opposite direction.

**[0018]** It is also possible to have combinations of the drum movement programs described above in each phase of movement and the said drum movement programs can also vary from one phase of movement to the next in the course of the drying phase.

**[0019]** In combination with the alternating rotation, that is referring to the directions of rotation of the drum, it is advantageous for the speeds of rotation to be be-

tween approximately 80 and 200, preferably between approximately 100 and 150 revolutions per minute of the said drum.

[0020] By means of these arrangements, during the phase of alternating rotation of the drum the laundry is held against the sides of the drum, leaving a free region in the centre which allows the hot drying air to pass through along the full length of the drum.

[0021] The preset speed of rotation is sufficiently high to press the laundry gently against the sides of the drum without compressing it into too compact a mass and without causing it to continue to cling to the sides of the drum even when the drum has stopped.

[0022] During the pause, i.e. when the drum stops, the laundry at the top of the drum can therefore tumble down. This ensures that all the items or all parts of the items of the laundry come into contact with the stream of hot air.

[0023] The drying phase in accordance with the invention is repeated throughout the duration of the drying process. In this way all the laundry contained in the drum is subjected to the action of the hot drying air, in a uniform manner, both as regards laundry situated close to the hot air inlet and that close to the hot air outlet, as well as that on the bottom of the drum.

[0024] The process according to the invention is very simple and, as is clear, requires no structural modifications to machines currently in use. Moreover the process achieves greater drying efficiency with total drying times 20 to 40% shorter than can be achieved by currently known methods.

[0025] Needless to say, the reduction in drying times also means that less energy is used.

[0026] The process according to the invention is not limited to the embodiments described above but can be greatly varied without thereby departing from the underlying principle set forth above and claimed below.

## Claims

1. Process for drying laundry, or the like, in washer-driers and driers, or the like, in which the laundry, which has first undergone removal of a certain amount of water, by spinning, is subjected to the action of a stream of hot air while at the same time being agitated/moved to produce a lifting/tumbling of the laundry and greater exposure to the stream of hot air, the said process comprises further at least two, or more, phases of movement of the laundry, or the like, alternating with pauses, in which, during the phases of movement, the laundry is subjected to a motion of movement/agitation which concentrates the said laundry in order to leave a considerable free volume for the passage of the hot drying air through the laundry containment vessel, preferably forming a channel for the passage of the drying air through the laundry which is distributed uniformly around this channel, and in which the drying laundry is subjected to an alternating motion in two different directions, preferably opposite directions, each phase of movement being carried out at a predetermined different speed of movement of the laundry, **characterized in that** the said predetermined different speed of each phase of movement increases as the drying process proceeds.
2. Process according to Claim 1, **characterized in that** during the phases of movement, the speed of movement of the laundry is selected such that the inertial forces acting on the laundry do not cause excessive compression and compacting of the said laundry, and during the pause when the movement stops the laundry is tumbled.
3. Process according to Claim 1 or 2, **characterized in that** during washing the drum is rotated at a predetermined speed while the speed of movement of the laundry during the movement phases of the drying process is faster than the speed during washing by approximately a factor of up to 3.
4. Process according to one or more of the preceding claims, **characterized in that** the speeds of movement of the laundry may be variable to suit the types of fabric being handled.
5. Process according to one or more of the preceding claims, in which drying is performed in driers or washer-driers having a cylindrical drum with a horizontal and/or vertical axis of rotation.
6. Process according to Claim 5, **characterized in that** the alternating movement of the laundry is achieved by an alternating rotation of the drum in both clockwise and anticlockwise directions of rotation.
7. Process according to Claim 6, **characterized in that** the alternating rotation, referring to the two opposite directions of rotation, is in the form of an oscillating motion of the drum in both directions of rotation with angular amplitudes smaller than a complete revolution in each of the two directions.
8. Process according to one or more of the preceding claims, **characterized in that** during each phase of movement the drum performs one or more rotations in each of the two directions of rotation, which rotations are carried out in each direction without interruption, or else each rotation or at least two rotations in one direction alternate with one or at least two rotations in the opposite direction.
9. Process according to one or more of Claim 5 to 8, **characterized in that** the speed of rotation of the

drum during the phases of movement of the laundry is between approximately 80 and approximately 200, preferably between approximately 100 and approximately 150 revolutions per minute.

### Patentansprüche

1. Prozess zum Trocknen von Wäsche o.ä. in Waschtrocknern oder Trocknern o.ä., in denen die Wäsche, der zuerst durch Schleudern eine bestimmte Menge Wasser entnommen wurde, der Wirkung eines Stroms heißer Luft ausgesetzt und zugleich geschüttelt/bewegt wird, um ein Anheben/Herunterfallen der Wäsche und ein verstärktes Aussetzen an den Strom heißer Luft zu bewirken, der genannte Prozess umfasst weiter mindestens zwei oder mehr Phasen der Bewegung der Wäsche o.ä., die mit Pausen abwechseln, wobei die Wäsche während der Bewegungsphasen einer Bewegung des Bewe-gens/Schüttelns ausgesetzt wird, die die genannte Wäsche zusammendrängt, um einen erheblichen freien Raum für die Passage der heißen Trock-nungsluft durch die Trockenkammer zu lassen, wo-bei vorzugsweise ein Kanal für die Passage der Trocknungsluft durch die Wäsche entsteht, die gleichförmig um diesen Kanal verteilt ist, **dadurch gekennzeichnet, dass** die trocknende Wäsche zwei alternierenden Bewegungen in zwei verschie-dene, vorzugsweise entgegengesetzte Richtungen ausgesetzt wird, jede Bewegungsphase mit einer vorgegebenen unterschiedlichen Bewegungsgeschwindigkeit der Wäsche ausgeführt wird, wobei die genannte Geschwindigkeit in dem Maße zu-nimmt, in dem die Wäsche allmählich trockener wird.
2. Prozess gemäß Anspruch 1, **dadurch gekenn-zeichnet, dass** während der Bewegungsphasen die Geschwindigkeit der Bewegung der Wäsche so gewählt wird, dass die auf die Wäsche wirkenden Massenkräfte nicht eine zu starke Komprimierung und Verdichtung der genannten Wäsche bewirken, und die Wäsche während der Pause, wenn die Be-wegung stoppt, herunterfällt.
3. Prozess gemäß Anspruch 1 oder 2, **dadurch ge-kenntzeichnet, dass** die Trommel während des Waschens mit einer vorgegebenen Geschwindig-keit gedreht wird, wobei die Bewegungsgeschwin-digkeit der Wäsche während der Bewegungspha-sen des Trocknungsprozesses ungefähr um einen Faktor von 1,5 bis 3 schneller ist als die Geschwin-digkeit während des Waschens.
4. Prozess gemäß einem oder mehreren der vorste-henden Ansprüche, **dadurch gekennzeichnet, dass** die Geschwindigkeiten der Bewegung der

Wäsche variabel sein können, um der behandelten Textilart angepasst zu werden.

5. Prozess gemäß einem oder mehreren der vorste-henden Ansprüche, bei dem das Trocknen in Trock-nern oder Waschtrocknern mit einer zylindrischen Trommel mit einer horizontalen und/oder vertikalen Drehachse erfolgt.
6. Prozess gemäß Anspruch 5, **dadurch gekenn-zeichnet, dass** die alternierende Bewegung der Wäsche durch eine alternierende Drehung der Trommel sowohl im Uhrzeigersinn als auch gegen den Uhrzeigersinn erreicht wird.
7. Prozess gemäß Anspruch 6, **dadurch gekenn-zeichnet, dass** die alternierende Drehung, die die zwei entgegengesetzten Drehrichtungen betrifft, die Form einer oszillierenden Bewegung der Trom-mel in beide Drehrichtungen mit Winkelweiten hat, die kleiner als eine vollständige Umdrehung in jede der zwei Richtungen sind.
8. Prozess gemäß einem oder mehreren der vorste-henden Ansprüche, **dadurch gekennzeichnet, dass** die Trommel während jeder Bewegungspha-se eine oder mehrere Drehungen in beide Drehrich-tungen ausführt, wobei die Drehungen in jede Rich-tung ohne Unterbrechung ausgeführt werden oder entweder jede Drehung oder zumindest zwei Dre-hungen in eine Richtung mit einer oder mindestens zwei Umdrehungen in die entgegengesetzte Rich-tung abwechseln.
9. Prozess gemäß einem oder mehreren der Ansprü-che 5 bis 8, **dadurch gekennzeichnet, dass** die Drehzahl der Trommel während der Phasen der Be-wegung der Wäsche zwischen ungefähr 80 und un-gefähr 200, vorzugsweise zwischen ungefähr 100 und ungefähr 150 Umdrehungen pro Minute be-trägt.

### Revendications

1. Procédé pour blanchisserie ou établissement simi-laire, dans des lave/sèche-linge et sèche-linge ou appareils similaires où le linge, qui a été préalable-ment soumis à essorage, est assujéti à l'action d'un flux d'air chaud tout en étant agité/déplacé pour pro-duire une ascension/chute du linge et à une plus grande exposition au flux d'air chaud, ledit procédé se composant en outre de deux phases ou plus de mouvement du linge ou similaire s'alternant avec des pauses et au cours desquelles, pendant les phases de mouvement, le linge est assujéti à un mouvement/agitation qui concentre ledit linge afin de laisser un important volume libre pour le passa-

ge de l'air chaud séchant à travers le tambour contenant le linge, formant de préférence un canal pour le passage de l'air chaud à travers le linge qui est réparti uniformément autour de ce canal, **caractérisé en ce que** le linge en train de sécher est assujéti à un mouvement alterné dans deux sens, de préférences opposés, chaque phase de mouvement étant effectuée à une vitesse de mouvement du linge différente et prédéfinie, cette vitesse augmentant au fur et à mesure que le linge sèche progressivement.

2. Procédé selon la Revendication 1, **caractérisé en ce que** la vitesse de mouvement du linge pendant les phases de mouvement est sélectionnée de façon à ce que les forces d'inertie s'exerçant sur le linge ne provoquent pas une compression et un compactage excessifs dudit linge, et pendant la pause, lorsque le mouvement s'arrête, le linge chute. 15 20
3. Procédé selon la Revendication 1 ou 2, **caractérisé en ce que** le tambour tourne à une vitesse prédéfinie pendant le lavage tandis que la vitesse de mouvement du linge pendant les phases de mouvement du processus de séchage est plus rapide que la vitesse pendant le lavage d'un facteur allant de 1,5 à 3. 25
4. Procédé selon une ou plusieurs des revendications ci-dessus, **caractérisé en ce que** la vitesse de mouvement du linge peut varier pour s'adapter au type de tissu traité. 30
5. Procédé selon une ou plusieurs des revendications ci-dessus, où le séchage est effectué dans des sèche-linge ou des lave/sèche-linge ayant un tambour cylindrique avec un axe de rotation horizontal et/ou vertical. 35 40
6. Procédé selon la Revendication 5, **caractérisé en ce que** le mouvement alterné du linge est assuré par une rotation alternée du tambour à droite et à gauche. 45
7. Procédé selon la Revendication 6, **caractérisé en ce que** la rotation alternée, se référant à deux sens de rotation opposés, se présente sous forme de mouvement oscillatoire du tambour dans les deux sens de rotation avec des amplitudes angulaires plus petites qu'un tour complet dans chacun des deux sens. 50
8. Procédé selon une ou plusieurs des revendications ci-dessus, **caractérisé en ce que** le tambour effectue une ou plusieurs rotations pendant chaque phase de mouvement, ces rotations étant effectuées dans chaque sens sans interruption ou bien chaque 55

rotation ou au moins deux rotations dans un sens s'alternant avec une ou au moins deux rotations dans le sens opposé.

- 5 9. Procédé suivant une ou plusieurs revendications de la N° 5 à la N° 8, **caractérisé en ce que** la vitesse de rotation du tambour pendant les phases de mouvement du linge oscille entre environ 80 et 200 tours par minute, de préférence entre environ 100 et 150 tours par minute.