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(54) Title: HOLDER FOR A WALL-IRONING RING

(57) Abstract

The invention relates to a holder (11) for a wall-ironing ring which has the feature that the centering ring is embodied as sizing ring (18) which is adhered with its whole radial outer surface to the peripheral surface of the annular recess and has a radial inner surface the form thereof is adapted precisely to the outer peripheral surface of the wall-ironing ring such that this can be arranged clamping or at least close fitting in the centering ring.

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HOLDER FOR A WALL-IRONING RING

The invention relates to a holder for a wall-ironing ring

for reducing to a desired value, by wall-ironing, of the thickness of the peripheral wall of a metal cup-shaped article in order to obtain a cup, a battery casing, a cartridge case, a container for closure with a cover after filling or other cup-shaped article with a base and a peripheral wall forming an entity therewith,

which wall-ironing ring serves to co-act with a recipro-
cally drivable wall-ironing mandrel movable coaxially relative to the non-movably disposed wall-ironing ring, the cross sectional form of this mandrel corresponding with the internal shape of the wall-ironing ring such that the wall thickness of a cup-shaped article arranged on the mandrel, after having passed through the wall-ironing ring through axial driving of the mandrel, has undergone the desired reduction whereafter the thus formed cup-like article can be removed from the mandrel,

which ring holder comprises:

- an annular radial recess for receiving the ring,
- locking means for locking the ring against axial displacement, and
- a centering ring of rubber elastic material which is present in the annular recess between the holder and the ring and which holds the ring at a radial interval from the radial bottom of the recess.

In a known holder the centering ring is embodied as rubber elastic O-ring. As a result the ring holder partly carried thereby, and thus the wall-ironing ring itself, display a certain displaceability which serves to give a certain tolerance in the wall-ironing process with the purpose of providing the finally obtained cup-like article with the most
homogeneous possible peripheral wall thickness.

Even if the wall-ironing ring and the mandrel are mutually aligned with great accuracy it has been found in practice impossible to prevent the upper rim of the formed cup-like article not having the desired virtually straight form but being sloping.

This results in problems stripping the formed article from the mandrel. After stripping the article a trimming process is carried out in a subsequent station wherein the cup-like article is brought to the desired length. The greater the slope of the outer rim, the greater the material loss entailed in the trimming process.

The known art cannot, even with extremely accurate aligning of wall-ironing rings and mandrel, guarantee any smaller inaccuracy of the optimum straight form of the rim than in the order of 4 to 6 mm.

The invention has for its object to embody a holder for a wall-ironing ring such that the cup-like articles obtained therewith have a standing wall of a wall thickness that is homogeneous within narrow tolerances, while the outer rim is virtually completely straight, whereby the required trimming process need only remove little material.

In order to realize the above mentioned objectives the invention provides a holder for a wall-ironing ring of the type stated in the preamble which has the feature that the centering ring is embodied as sizing ring which is adhered with its whole radial outer surface to the peripheral surface of the annular recess and has a radial inner surface the form whereof is adapted precisely to the outer peripheral surface of the wall-ironing ring such that this can be arranged clamping or at least close fitting in the centering ring.

The centering ring can for instance be embodied in silicon rubber which can adhere very well during curing to the peripheral surface of the annular recess. A pre-manufactured centering ring can also be adhered to that peripheral surface with adhesive.
Very good results are achieved with an embodiment wherein the centering ring has a large axial dimension relative to its radial dimensions.

In a preferred embodiment the holder according to the invention displays the feature that the centering ring is adhered to the peripheral surface of the annular recess by vulcanizing.

In a further variant the holder has the feature that the annular recess has an additional annular radial recess positioned at an interval from the axial ends thereof and wherein is situated a correspondingly shaped part of the centering ring.

As stated, the clamping or at least close fitting of the wall-ironing ring in the centering ring is of crucial importance for achieving the objectives according to the invention. It has been found that in this respect use can with advantage be made of an embodiment in which the inner surface of the centering ring is subjected to an after-treatment in order to obtain a form exactly adapted to the outer peripheral surface of the wall-ironing ring. The centering ring present in the holder can for instance be ground to size. It will be apparent that the final alignment of the total wall-ironing device must take place such that the axial displacement of the wall-ironing mandrel has to be precisely in line with the generally exactly round shape of the active annular inner surface of the wall-ironing ring.

The invention further relates to a wall-ironing device, comprising

- a wall-ironing mandrel,
- drive means for axial reciprocating driving thereof,
- at least one holder for a wall-ironing ring,
- a wall-ironing ring received therein and placed coaxially with the mandrel,
- means for placing successive metal cup-like articles on the mandrel, and
- means for removing a processed cup-like article from the mandrel. According to the invention such a wall-ironing device
has the feature that
the ring holder is of the type as according to any of
the foregoing claims.
Finally, the invention relates to a cup-like metal ar-
5 ticle obtained with the above specified wall-ironing device.
Attention is drawn to the fact that it is not entirely
clear which physical mechanisms form the basis of the dis-
played superior operation of the holder according to the
invention. It could be the case that there is an improvement
in the more or less elastic suspension of the wall-ironing
ring in the mechanically very stiff, generally steel holder.
A first conceivable explanation of the operation of the inven-
tion could be sought in the spatial spring characteristic of
the centering ring. It seems improbable that the accurate
form of the inner surface thereof is the only decisive factor
in the proven good operation, since the centering ring could
otherwise be omitted entirely and the wall-ironing ring could
be coupled to the holder without a resilient medium. Such a
configuration has been found unusable. It is evidently of
fundamental importance that the wall-ironing ring has a cer-
tain (small) freedom of movement in order to be able to adapt
dynamically to the play of forces occurring during the wall-
ironing process.
It can be stated generally that the holder according to
the invention results in a very considerable material saving
as a consequence of the trimming process removing less ma-
terial. This a great economic advantage.
It has further been found that the wall-ironing rings
have a considerably extended tool life. It has been establish-
30 ed from extensive life tests that the wall-ironing rings are
usable for at least three times longer a period. An explana-
tion for this could perhaps be that the components involved
have a considerably lesser tendency to sloping wear than in
the known art. The extended tool life of the wall-ironing
rings also has the advantage, as will be apparent, that there
is less disruption from stoppage of the wall-ironing device
for changing ring holders, while furthermore less time and
expense are necessary for restoring the wall-ironing rings to a good condition.

Surprisingly, it has also been established that the axial guiding system of the wall-ironing mandrel has become of secondary importance through use of the holder according to the invention. In the known art it has always been the endeavour to align the wall-ironing rings and the mandrel with extreme precision relative to one another. Despite all research efforts in this direction success has not been achieved in obtaining the above described advantages of the invention.

It must also be remarked that in all wall-ironing devices of the type in question the cup-like articles obtained are removed from the mandrel by means of a ring of stripping fingers. Mandrels are often embodied with pressure lines which have the purpose of facilitating the stripping of an article from the mandrel by the fingers by feeding pressure medium between the mandrel and the cup-like articles. Because of the sloping form of the free rim of the obtained cup-like articles it has not always been possible in the state of the art to prevent the stripping process causing problems, in particular because the stripping fingers exerted an unhomogeneously distributed force on the sloping outer rim of an article. It thus often occurred that an article either caused jamming of the device when the mandrel was retracted or was indeed stripped but displayed wrinkles or folds, whereby the article had to be rejected.

The invention will now be elucidated with reference to the annexed drawing, wherein:

Fig. 1 shows in lengthwise section a unit with a number of ring holders, or a toolpack, according to the known art;

fig. 2 shows a highly schematic lengthwise section through the essential components of a wall-ironing device with ring holders according to the invention;

fig. 3 shows a variant of a ring holder according to the invention in cross section; and

fig. 4 is a view corresponding with fig. 1 of a toolpack
according to the invention.

Fig. 1 shows a toolpack 1 according to the known art. This toolpack comprises a first wall-ironing ring 2 for bringing to the roughly correct size the wall thickness of a cup-like input article for processing. This first ring is therefore designated as sizing ring. The direction in which the cup-like article, which is carried by a mandrel (not drawn), passes through the toolpack 1 is indicated with an arrow 3. After passing through the sizing ring 2 the wall is subsequently subjected to a wall-ironing process by four successive wall-ironing rings designated 4, 5, 6 and 7. A stripping device 8 is designated schematically with a block. This stripping device serves to remove the obtained cup-like article from the mandrel.

All five wall-ironing rings are rigidly arranged in a carrier ring which for the sake of convenience are all designated with 9. The carrier rings 9 are encircled by O-rings 10 of rubber elastic material. These are situated in annular recesses in ring holders 11 (wall-ironing rings 2 and 4), 12 (wall-ironing ring 5) and 13 (wall-ironing rings 6 and 7). As will be apparent with reference to fig. 1, all carrier rings 9 and the wall-ironing rings 2, 4, 5, 6, 7 carried thereby are locked against axial displacement in the direction of the arrow 3. The construction shown is such that a permanent very accurate alignment of the rings 2, 4-7 is ensured.

Lubricant lines are generally designated with 14. These serve to feed lubricant and coolant to the outer surface of an article subjected to a wall-ironing process.

Fig. 2 shows highly schematically a toolpack 15 which corresponds in basic construction with the toolpack 1 according to the state of the art. Fig. 2 shows a wall-ironing mandrel 16 on which a cup-like article 17 is arranged by means of feed means (not drawn) and which has to be subjected to a wall-ironing process by the rings 2, 4, 5, 6, 7. In contrast to the ring holders 11, 12 13 according to fig. 1 the respective wall-ironing rings with carrier rings 2, 9; 4, 9; 5, 9; 6, 9; 7, 9 are encircled by rubber elastic sizing
rings 18 which are adhered with their whole radial outer surface to the peripheral surface of annular recesses 19 wherein the rings 2, 9; 4, 9; 5, 9; 6, 9; 7, 9 are arranged.

As shown in fig. 2 the centering rings 2 embodied as sizing rings have a large axial dimension relative to the radial dimensions.

In this embodiment the centering rings 18 consist of rubber and are adhered to the peripheral surface of the associated annular recess by vulcanizing.

Attention is drawn to the fact that the three ring holders in fig. 2 are respectively designated 11', 12', 13' to illustrate their functional similarity with the ring holders 11, 12, 13 according to fig. 1.

Fig. 3 shows an alternative of the ring holder 11' according to fig. 2 which is therefore designated 11''. As fig. 3 shows, annular recesses 20 each have an additional annular radial recess 21 positioned at an interval from the axial ends thereof. The centering rings 22 embodied as sizing rings extend with a correspondingly shaped portion into these extra recesses 21. In this embodiment the centering rings 22 also have a large axial dimension relative to their radial dimensions.

Attention is drawn to the fact that fig. 3 shows in slightly more detail that the ring holder 11'' is assembled from ring portions 24, 25, 26 mutually coupled by bolts 23. The ring holders 11', 12' and 13' according to fig. 2 are assembled in like manner. Fig. 2 only shows their structure schematically.

Fig. 4 shows a toolpack 27 whereof the general structure corresponds with the toolpack 1 according to fig. 1, but varies therefrom in the sense that the carrier rings 9 are supported by the centering rings 22 in the manner shown in fig. 3. Functionally similar components are designated in fig. 4 with the same reference numerals with accent.

It is noted that the centering rings 22, after being adhered to the ring holders 11'', 12'' and 13'' by vulcanizing, are ground to size with great precision.
CLAIMS

1. A holder for a wall-ironing ring for reducing to a desired value, by wall-ironing, of the thickness of the peripheral wall of a metal cup-shaped article in order to obtain a cup, a battery casing, a cartridge case, a container for closure with a cover after filling or other cup-shaped article with a base and a peripheral wall forming an entity therewith,

which wall-ironing ring serves to co-act with a reciprocally drivable wall-ironing mandrel movable coaxially relative to the non-movably disposed wall-ironing ring, the cross sectional form of this mandrel corresponding with the internal shape of the wall-ironing ring such that the wall thickness of a cup-shaped article arranged on the mandrel, after having passed through the wall-ironing ring through axial driving of the mandrel, has undergone the desired reduction whereafter the thus formed cup-like article can be removed from the mandrel,

which ring holder comprises:

- an annular radial recess for receiving the ring,
- locking means for locking the ring against axial displacement, and
- a centering ring of rubber elastic material which is present in the annular recess between the holder and the ring and which holds the ring at a radial interval from the radial bottom of the recess.

characterized in that the centering ring is embodied as sizing ring which is adhered with its whole radial outer surface to the peripheral surface of the annular recess and has a radial inner surface the form whereof is adapted precisely to the outer peripheral surface of the wall-ironing ring such that this can be arranged clamping or at least close fitting in the centering ring.
2. A holder as claimed in claim 1, characterized in that the centering ring has a large axial dimension relative to its radial dimensions.

3. A holder as claimed in claim 1, characterized in that the centering ring is adhered to the peripheral surface of the annular recess by vulcanizing.

4. A holder as claimed in claim 1, characterized in that the annular recess has an additional annular radial recess positioned at an interval from the axial ends thereof and wherein is situated a correspondingly shaped portion of the centering ring.

5. A holder as claimed in claim 1, characterized in that the inner surface of the centering ring is subjected to an after-treatment in order to obtain a form exactly adapted to the outer peripheral surface of the wall-ironing ring.

6. A wall-ironing device, comprising a wall-ironing mandrel, drive means for axial reciprocating driving thereof, at least one holder for a wall-ironing ring, a wall-ironing ring received therein and placed coaxially with the mandrel, means for placing successive metal cup-like articles on the mandrel, and means for removing a processed cup-like article from the mandrel, characterized in that

the ring holder is of the type as claimed in any of the foregoing claims.

7. A cup-like metal article obtained by making use of a wall-ironing device as claimed in claim 6.
**INTERNATIONAL SEARCH REPORT**

**I. CLASSIFICATION OF SUBJECT MATTER**

According to International Patent Classification (IPC) or to both National Classification and IPC.

IPC: B 21 D 22/28

**II. FIELDS SEARCHED**

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Date of the Actual Completion of the International Search: 9th November 1990

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International Searching Authority: EUROPEAN PATENT OFFICE

Signature of Authorized Officer: [Signature]
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