The invention relates to a plastic closure device (1) for a tubular bag made of plastic or a multi-layer plastic film, comprising at least one bottom part (5) that has a spout (7), a spout opening (8), and a flange (4). The flange (4) has an energy-introduction arrangement (10) on the flange underside surface (9) of the flange. The energy-introduction arrangement can be connected to the plastic material or the plastic film of the tubular bag by means of ultrasonic welding. The energy-introduction arrangement (10) has at least one energy-introduction rib (12) arranged concentrically to the spout opening (8) in the peripheral region (11) of the flange (4). A concentrating rib (13) is provided on the flange underside surface (9). The concentrating rib extends within the energy-introduction arrangement (10) and protrudes from the flange underside surface (9) higher than the energy-introduction rib (12) and also extends directly adjacent to the spout opening (8).
PLASTIC CLOSURE DEVICE FOR A TUBULAR BAG

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a plastic closure device for a tubular bag.

SUMMARY OF THE INVENTION

[0002] The invention particularly relates to a plastic closure device for a tubular bag from a plastic material or from a multilayered plastic film, in which the plastic closure device comprises at least one lower part with a spout, a spout opening and a flange. A lower part of such a type is provided for fastening onto a tubular bag by means of ultrasonic welding; it therefore itself also consists of a thermoplastic. Moreover, in a lower part of such a type an energy-introducing arrangement is arranged on the flange on the face of the flange lower side, said energy-introducing arrangement serving to conduct and to concentrate the energy introduced by means of ultrasound such that a welded connection which is reliable and tight is created between the plastic parts (tubular bag and flange) to be connected. Usually, the energy-introducing arrangement has to this end at least one energy-conducting rib which is arranged concentrically with the spout opening in the peripheral region of the flange.

[0003] It is thus understood that the solution according to the invention should be suitable for what are referred to as tubular bags, usually called “pouches” in industry language. Tubular bags of such a type are nowadays often manufactured from multilayered plastic films. Known multilayered plastic films have, for example, layered constructions as follows: PP-AL-PE and PP-PETSiOx-PE. The ultrasonically weldable outer layer thus often consists of polypropylene (PP) and the inner layer of polyethylene (PE). The intermediate layers often serve as protection against light.

[0004] Moreover, it goes without saying that the plastic closure device as a rule of course may or may contain still further components, such as, for example, an upper part in the form of a closure cap, an opening device and a tamper-proof band. Since these components, however, are most likely known per se and not of consequence for the functionality of the invention, for the sake of simplification they have been either entirely omitted or, where necessary, only indicated.

[0005] Known solutions for plastic closure devices which are fastenable by means of ultrasonic welding are shown, for example, in document JP-2000016453, two energy-conducting ribs which run concentrically to the flange rim being shown here, or document JP-2000344264, which shows an identical plastic closure device for tubular bags in which merely one energy-conducting rib which runs concentrically with the flange rim is present.

[0006] A problem, which has already been alluded to in JP-2000016453, consists in that, in the case of ultrasonic weldings of this type, there is always a certain risk that what are referred to as “pinholes” are created in the sealing film in the region of the spout opening. Pinholes are undesirable small leakage which compromise the tightness of the tubular bag, which can of course lead to serious hygiene problems and shelf-life problems in the case of packaging for foodstuffs in particular. The exact cause of the creation of pinholes does not appear to have been fully clarified as yet, such that it is to be assumed that the previous attempts at a solution are at least partly still of a rather empirical nature. Overall, JP-2000016453 does not appear to contain any detailed disclosure as to whether the solution with merely two energy-conducting ribs which run concentrically with the flange rim can likewise reliably prevent a pinhole formation in the case of other or merely similar designs too.

[0007] A further problem, which arises in particular in the case of plastic closure devices having an opening device with a cutting device, consists in that to improve or even to enable in the first place the ability to cut open in the region of the spout opening, a targeted weakening of the container wall in the form of a scoring or another kind of formation of a predetermined breaking point has to be provided locally. This is often the case with film layers having a proportion of paper or cardboard, but it may often also be necessary in the case of film composites having multilayered plastic films. Of course, the configuration of predetermined breaking points depends on the type, the construction and the thickness of the film composite. However, the introduction of predetermined breaking points in principle always has the disadvantage that the plastic closure device has to be positioned very precisely in relation to the tubular bag (or simply in relation to the container with which it is being used) during production, since as a rule even slight deviations from the concentricity of the spout opening and the predetermined breaking point lead to the cutting-out operation to some extent being greatly impeded or even made impossible. This is, of course, particularly unpleasant when using beverage packagings, because splashes can, of course, very easily be created in the case of an increase in the expenditure of force for opening, in particular in the case of “soft” packaging of the tubular-bag type.

[0008] It is, therefore, the object of the invention to provide an improved plastic closure device for tubular bags from plastic or a multilayered plastic film.

[0009] The solution lies in that, in the case of a plastic closure device of the generic type for a tubular bag from plastic or from a multilayered plastic film, which is connectable by means of ultrasonic welding to the tubular bag and which, for introducing the ultrasonic energy, has an energy-introducing arrangement with energy-conducting ribs on a face of the flange lower side, a concentration rib, which runs concentrically offset to the energy-conducting arrangement and which, with respect to the energy-conducting rib, protrudes higher from the face of the flange lower side and is also arranged immediately adjacent to the spout opening, is provided on the face of the flange lower side.

[0010] It has been demonstrated that the introduction of a concentration rib which runs within the energy-conducting arrangement and which, with respect to the energy-conducting rib, protrudes higher from the face of the flange lower part and is also arranged immediately adjacent to the spout opening is even capable of combining a number of advantages.

[0011] On the one hand, this succeeds in collecting and redirecting the ultrasonic energy to another site of action without undesirable side effects and in focusing it there, which ultrasonic energy, in the case of annular sonotrodes used for ultrasonic welding, is otherwise mainly concentrated in the center of the sonotrodes and in this manner creates the undesirable pinholes. It has been demonstrated, in fact, that the creation of pinholes can be prevented with great reliability in this way and that the suitability for storage particularly of packagings for foodstuffs is thus greatly improved, since the tightness of the packaging is ensured.

[0012] On the other hand, the ultrasonic energy redirected and focused in this way can still also be utilized in a profitable
way. Since the desired site of action of the redirected ultrasonic energy is now situated in the immediate vicinity of the concentration rib, the resulting heat concentration in this region causes a modification of the structure and the shape in the plastic or in the multilayered plastic film of the tubular bag. Since, with respect to the energy-conducting rib or with respect to the energy-conducting ribs, respectively, the concentration rib protrudes higher from the face of the flange lower side, greater heating results at this point upon the introduction of ultrasonic energy. On account of this, the material of the plastic or of the plastic film is locally more strongly softened up and flows away from the concentration rib. The material thickness of the plastic or of the plastic film is thus reduced at this point. At the same time, after removal of the sonotrode and after cooling, a structural modification, which manifests itself as locally increased brittleness or as reduced elasticity of the plastic film, also still results in the plastic. Thus, along with the introduction of a concentration rib according to the invention, a desirable predetermined breaking point is also still obtained at the same time. The main advantage is, of course, that the otherwise additionally necessary operational steps, which would add cost and reduce quality, for the separate manufacture of a weakened zone in the spout region and the outlay for the precise positioning of the plastic closure device with respect to this weakened zone are completely dispensed with, since all this can be taken care of in a single operational step, namely the welding by means of ultrasound of the plastic closure device.

The arrangement according to the invention is particularly advantageous in the case of a plastic closure device which has an opening device with at least one cutting tooth, as long as said at least one cutting tooth is movable in the vicinity of the concentration rib in order to cut open the plastic material or the multilayered plastic film there. Since the energy-conducting rib is arranged immediately adjacent to the spout opening of the spout and the cutting tooth or the cutting teeth also move in the vicinity thereof, the cutting forces become effective in a weakened material region which, of course, facilitates the opening of the plastic closure device.

The concentration rib itself is advantageously provided with a rounded elevation, since in this way, rather than surface contact, linear contact with the plastic or the multilayered plastic film material of the tubular bag is created, this leading to a higher concentration of the ultrasonic energy and thus to locally higher heating.

It is furthermore advantageous in many cases if the concentration rib is configured in a merely partially encircling manner around the spout opening. In this way, it is possible to prevent or at least hinder the easily removable piece (due to the weakening region) from falling from the spout region into the interior of the container. In the case of plastic closure devices having an opening device with one or more cutting teeth, the possibility of positioning the only partially configured concentration rib along the circumference of the spout opening—and thus also of that material part which can be cut out easily—may also still be utilized in such a manner that the partially cut-out material piece after completion of the cutting-out operation comes to lie behind the cutting teeth in such a way that the opening created does not automatically (partially) close again as a result of the restoring forces.

It should additionally be mentioned in principle that the plastic closure device according to the invention is suitable in principle for various types of opening devices (installed in the plastic closure device). Despite only being shown in the following by way of a single exemplary embodiment having one opening device with a cutting device, applications with opening devices in which the plastic or the multilayered plastic film is pierced, punctured or torn off are also possible.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows the arrangement in principle of a plastic closure device and of a sonotrode in an ultrasonic welding operation.

FIG. 2 shows a partial side view of the lower part of a plastic closure device according to the invention, having an opening device.

FIG. 3 shows a partial sectional view of the lower part of the plastic closure device as per FIG. 2, and

FIG. 4 shows the lower part in a simplified view from below.

DETAILED DESCRIPTION

FIG. 1 shows the arrangement in principle of a plastic closure device 1 and of a sonotrode 2 for ultrasonic welding in an ultrasonic welding operation. To this end, the plastic closure device 1 is placed at the desired point onto the shell material 3 (plastic or multilayered plastic film) of the tubular bag and then welded to the shell material 3 in the region of a flange 4. It was already mentioned at the outset that the ultrasonic energy in the case of annular sonotrodes used for ultrasonic welding is at times preponderantly concentrated in a center region Z which is indicated by arrows and thus leads to the undesirable pinholes in this region of the shell material 3.

FIG. 2 shows a partial side view of a lower part 5 of a plastic closure device 1 according to the invention, having an opening device with a cutting device 6 (see FIG. 3 in this context). The plastic closure device 1 comprises here at least the lower part 5 having a spout 7, a spout opening 8 and the flange 4. The spout opening 8 is, of course, a through opening.

An energy-introducing arrangement 10, which is connectable by means of ultrasonic welding to the plastic material or the plastic film of the tubular bag, i.e. the shell material 3 of the tubular bag, is arranged on the flange 4 on its face of the flange lower side 9.

The energy-introducing arrangement 10 is arranged concentrically with the spout opening 8 in a peripheral region 11 of the flange 4 and has at least one energy-conducting rib 12.

On the face of the flange lower side 9 a concentration rib 13 is present, which concentration rib 13 runs centrally offset to the energy-conducting arrangement 10 and, with respect to the energy-conducting rib 12, protrudes higher from the face of the flange lower side 9, and moreover is arranged immediately adjacent to the spout opening 8. The concentration rib 13 is thus surrounded by the energy-conducting arrangement 10.

Furthermore, the lower part 5 has an external thread 14 onto which a closure-cap part (not illustrated), which likewise belongs to the plastic closure device, is screwed. Also visible are a retaining bend 15 and a retaining cam 16 which, upon initial use, serve to sever a tamper-proof band (likewise not illustrated) which belongs to the closure-cap
part from the latter. It is thus implied that the plastic closure device 1 having an opening device with a cutting device shown here is in principle of a known type in which, upon twisting off the closure-cap part, both the tamper-proof band is torn off and also the cutting device 6 located in the interior of the lower part 5 is set into motion in order to cut open the shell material 3 of the tubular bag in the region of the spout opening 8.

**[0028]** FIG. 3 additionally shows a partial sectional view of the lower part 5 of the plastic closure device 1 as per FIG. 2. Some details, in particular the arrangement and the dimensional proportions of the energy-introducing arrangement 10 having the energy-conducting rib 12 and the concentration rib 13, can be more clearly identified here. Here, it is elucidated that the concentration rib 13 is a rounded elevation, or at least has a rounding. For a better understanding, the modification region 17, in which the material modification of the plastic toward higher brittleness caused by the higher temperature in the vicinity of the concentration rib 13 takes place, is also indicated here. Furthermore, a severance line 18 is plotted, which severance line 18 is intended to elucidate in which region the at least one cutting tooth 19 of the cutting device 6 (see FIG. 4 in this context) acts to cut the shell material 3 upon opening of the plastic closure device. The severance line 18 is thus situated in the vicinity of the concentration rib 13 and consequently at least also partially in the modification region 17.

**[0029]** Furthermore, part of an internal thread 20 which meshes with the cutting device 6, merely schematically plotted in FIG. 4, is identifiable in FIG. 3. Upon opening of the plastic closure device, the cutting device 6 is axially rotated by means of the internal thread 20 and moved toward the shell material 3.

**[0030]** Finally, FIG. 4 additionally shows the lower part 5 in a simplified view from below, that is from direction A. It is clearly identifiable here that the concentration rib 13 is arranged immediately adjacent to the spout opening 8 and that the concentration rib 13 here is configured in a merely partially encircling manner, namely approximately three quarters of the circumference, around the spout opening 8. The latter is, of course, a constructive detail and could also be selected so as to be different. It appears to be important, however, that the concentration rib 13 extends at least over the larger part of the circumference in order that the concentration effect of the ultrasonic energy applied to also takes place to a sufficient degree, such that the effect of the creation of pinholes in fact no longer arises.

**[0031]** The cutting device 6 is illustrated in FIG. 4 in a merely schematic manner and above all with respect to its arrangement within the spout opening 8. In the specific case, said cutting device 6 has a plurality of relatively small cutting teeth 19 which are arranged at the end of an indicated hollow cylinder. This embodiment is, however, only exemplary, since many other forms of construction are possible.

1. A plastic closure device (1) for a tubular bag from plastic or from a multilayered plastic film, wherein the plastic closure device (1) comprises at least one lower part (5) with a spout (7), a spout opening (8) and a flange (4) having a flange lower side and a peripheral region, and wherein an energy-introducing arrangement (10), which is connectable by means of ultrasonic welding to the plastic material or to the plastic film of the tubular bag, is arranged on the flange (4) on a face of the flange lower side (9), and wherein the energy-introducing arrangement (10) has at least one energy-conducting rib (12) which is arranged concentrically with a spout opening (8) in the peripheral region (11) of the flange (4), characterized in that a concentration rib (13), which runs centrically offset to the energy-introducing arrangement (10) and, with respect to the energy-conducting rib (12), protrudes higher from the face of the flange lower side (9) and is arranged immediately adjacent to the spout opening (8), is provided on the face of the flange lower side (9).

2. The plastic closure device (1) as claimed in claim 1, characterized in that the concentration rib (13) is an elevation which has a rounded cross section.

3. The plastic closure device (1) as claimed in claim 1, characterized in that the concentration rib (13) extends in a circular manner along an entire inner circumference of the flange (4).

4. The plastic closure device (1) as claimed in claim 1, characterized in that the concentration rib (13) extends along part of an inner circumference of the flange (4).

5. The plastic closure device (1) as claimed in claim 4, characterized in that the part of the inner circumference along which the concentration rib (13) extends is at maximum 350°.

6. The plastic closure device (1) as claimed in claim 1, characterized in that the plastic closure device (1) has an opening device with a cutting device (6) with at least one cutting tooth (19), wherein at least one cutting tooth (19), during actuation of the plastic closure device (1), is movable in an encircling manner in a vicinity of the concentration rib (13) in order to cut open the plastic material or the multilayered plastic film.

7. The plastic closure device (1) as claimed in claim 6, characterized in that the cutting device (6) is arranged and guided such that it cuts open only a pitch circle region of the tubular bag, said pitch circle region running at least almost immediately alongside the concentration rib (13).

8. The plastic closure device (1) as claimed in claim 1, characterized in that further conducting ribs (21), which run radially to the at least one energy-conducting rib (12) substantially up to a periphery of the flange (4), are also provided.

9. The plastic closure device (1) as claimed in claim 4, characterized in that the part of the inner circumference along which the concentration rib (13) extends 240° to 300°.

10. The plastic closure device (1) as claimed in claim 2, characterized in that the concentration rib (13) extends in a circular manner along an entire inner circumference of the flange (4).

11. The plastic closure device (1) as claimed in claim 1, characterized in that the concentration rib (13) extends along part of an inner circumference of the flange (4).

12. The plastic closure device (1) as claimed in claim 11, characterized in that the part of the inner circumference along which the concentration rib (13) extends is at maximum 350°.

13. The plastic closure device (1) as claimed in claim 12, characterized in that the plastic closure device (1) has an opening device with a cutting device (6) with at least one cutting tooth (19), wherein the at least one cutting tooth (19), during actuation of the plastic closure device (1), is movable.
in an encircling manner in a vicinity of the concentration rib (13) in order to cut open the plastic material or the multilayered plastic film.

14. The plastic closure device (1) as claimed in claim 13, characterized in that the cutting device (6) is arranged and guided such that it cuts open only a pitch circle region of the tubular bag, said pitch circle region running at least almost immediately alongside the concentration rib (13).

15. The plastic closure device (1) as claimed in claim 14, characterized in that further conducting ribs (21), which run radially to the at least one energy-conducting rib (12) substantially up to a periphery of the flange (4), are also provided.

16. The plastic closure device (1) as claimed in claim 11, characterized in that the part of the inner circumference along which the concentration rib (13) extends 240° to 300°.